Dietary Habits of New Zealand adolescent female vegetarians and non-vegetarians: intakes of protein-rich foods, discretionary foods, and fruit and vegetables

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Abstract

Background: Vegetarianism is characterised by the exclusion of flesh-based animal foods. Historically, this diet resulted in improved diet quality, typified by lower intakes of high fat, sugar, salt discretionary foods and higher intakes of fruits and vegetables compared to an omnivorous diet. However, intakes of protein-rich foods can be lacking in vegetarians. Vegetarianism appears to be increasing at the greatest rate amongst adolescent females, who have increased energy and nutrient needs. In New Zealand, there is little information on the dietary habits of vegetarian adolescents. It is unclear whether the modern vegetarian diet, where there is increased availability of processed high fat, sugar, and salt foods and vegetarian alternatives, remains more healthful than an omnivorous diet in this population.

Objective: To investigate frequency of intake of: protein-rich foods; fruit and vegetables; and discretionary foods among adolescent female vegetarians, and compare these with non-vegetarians.

Design: Cross-sectional survey of 248 females aged 15-18 years recruited from 13 high schools throughout New Zealand, and from targeted recruitment of vegetarians in Dunedin. Vegetarian status was self-reported at enrolment. Frequency of intake of animal and plant-based protein foods, discretionary foods, and fruit and vegetables were analysed through an online dietary habits questionnaire. Analysis was conducted in vegetarians (n=33) and non-vegetarians (n=215), with prevalence and 95% confidence intervals being used to compare between the two groups.
Results: Legumes were the most frequently consumed protein alternative in vegetarians with 57.6% (95% CI: 39.8-75.4) consuming 2-6 times a week. Other vegetarian protein alternatives were consumed infrequently at 3 times a month or less. More vegetarians excluded eggs than non-vegetarians (39.4% (95% CI: 21.8-57) vs 11.6% (95% CI: 7.3-15.9)). Among vegetarians, 66.7% (95% CI: 49.7-83.6) excluded cows milk, with 6% (95% CI: 0-14.7) including it once or more a day; compared to 20.9% (95% CI: 15.4-26.4) and 34.5% (95% CI: 28.0-40.8) respectively among non-vegetarians. Of vegetarians, 48.5% (95% CI: 30.5-66.5) excluded dairy, with 12.1% (95% CI: 0.37-23.9) including it once or more a day; compared to 8.9% (95% CI: 15.4-26.4) and 31.6% (95% CI: 25.4-27.9) among non-vegetarians. Vegetarians were more likely to choose chose plant-based milks 63.6% compared to non-vegetarians (17.2%). Vegetarians more frequently excluded discretionary foods than non-vegetarians. More vegetarians than non-vegetarians met and/or exceeded recommended serves per day of fruit (72.8% vs 56.3%) and vegetables (63.6% vs 31.2%)

Conclusion: The majority of vegetarians in this study appeared unlikely to meet national guidelines for meat alternatives and milk and milk products. In non-vegetarians, intakes of milk products also appeared insufficient to meet recommendations. This could potentially compromise intakes of important nutrients, particularly in vegetarians. Overall, vegetarians had more healthful dietary habits in terms of fruit, vegetables, and discretionary food intakes than non-vegetarians. However, vegetarian diets need to be well-planned to ensure intakes of protein containing foods and associated nutrients are not compromised. Further research into intakes of milk and milk products and vegetarian protein alternatives for
comparison to national guidelines is needed to confirm potentially low intakes of these protein-rich foods and associated nutrients in this population.
Preface

This thesis was conducted in Wellington through the University of Otago. The candidate conducted this study over 6 months under supervision of Rachel Brown as part of completing a Master of Dietetics (MDiet). Dr Jill Haszard and Dr Meredith Peddie were responsible for creating the research topic and study design, and gaining ethical approval.

This thesis was completed as part of a wider study: the Survey of Nutrition, Dietary Assessment and Lifestyles (SuNDiAL). As part of SuNDiAL, a dietary habits questionnaire was developed, which was administered to participants online at enrolment. This was the primary measure of the present thesis. Other measures undertaken as part of SuNDiAL which the candidate assisted with, such as 24 hour recalls, anthropometric measures, accelerometer administration, and blood and urine collection, are presented in other theses.
The candidate was responsible for the following tasks, of which extend beyond what was needed for completion of the present thesis:

- Completing a literature review on the topic of dietary habits, specifically in adolescent female vegetarians
- Co-ordinating and facilitating data collection with Kapiti College in Wellington
- Conducting data collection in Kapiti College participants: 24 hour recalls, anthropometrics, and sleep and activity information (accelerometer administration)
- Facilitating blood and urine data collection in Kapiti College alongside phlebotomists
- Entering 24 hour recall data into FoodWorks for Kapiti College participants and Whangarei participants
- Cleaning of dietary habit questionnaire data and anthropometric data for use in the present study
- Statistical analysis of dietary habit questionnaire data, with assistance from Rachel Brown (supervisor) where Stata analysis was needed
- Interpretation of results and writing up of thesis
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List of Abbreviations

**ANS:** 2008/2009 Adult Nutrition Survey

**AHS-2:** Adventist Health Study 2

**BMI:** Body mass index

**DHQ:** Dietary habits questionnaire

**FFQ:** Food frequency questionnaire

**NZDep:** New Zealand Deprivation Index 2013

**SD:** Standard deviation

**SSBs:** Sugar sweetened beverages

**SuNDiAL:** Survey of Nutrition, Dietary Assessment, and Lifestyles

**N:** Number

**WHO:** World Health Organisation
1. Introduction

Vegetarianism is a popular dietary pattern globally. Characterised by the exclusion of flesh-based animal foods (1), it is a diet historically renowned for its health benefits, animal welfare, and environmental considerations (2-4). Vegetarianism can undoubtedly be a healthful diet to follow. However, increases in commercially produced vegetarian foods that are high in fat, sugar, and salt (5), in a modern-day obesogenic environment (6, 7) may have compromised the healthfulness of a traditional vegetarian diet (3, 8). Furthermore, if the diet is not well-planned (9), intakes of protein-rich foods can be lacking in vegetarians (10, 11).

The prevalence of vegetarianism is appearing to rise at the greatest rate among the adolescent female population (12). Adolescents have increased nutrient and energy needs (13) which can be lacking in an inadequate vegetarian diet. Animal derived foods are typically protein-rich, and contain nutrients such as iron, (14) vitamin B12, vitamin D, zinc, and calcium (15), all of which are important for adolescent females (1, 13). Therefore, it is important to assess if commonly excluded animal-foods are being substituted with nutrient-rich vegetarian protein alternatives. Previous research has reported lower intakes of discretionary foods and higher intakes of fruit and vegetables among vegetarians, when compared to non-vegetarians (10, 11, 16, 17). This is indicative of an overall more healthful diet in vegetarians than non-vegetarians. Whether this remains true in the modern vegetarian diet in New Zealand adolescents is unknown.
There is limited literature globally assessing dietary habits among vegetarians, particularly adolescent vegetarians. Studies assessing vegetarianism typically have compared the vegetarian diet to a non-vegetarian diet and provided assessment of food intakes in grams or serves (10, 11, 17, 18). To the best of my knowledge, the only study in adolescents comparing vegetarian dietary habits to non-vegetarian was in an Adventist population in the United States in 2019 (18). However, the generalisability of this study population must be interpreted with caution given that Adventists practice healthful behaviours, such as abstaining from alcohol and smoking, beyond the inclusion of a vegetarian diet.

In New Zealand, the most recent dietary habit data in adolescent females was assessed in the 2008/2009 Adult Nutrition Survey (ANS) (19). The ANS identified that the majority of adolescent females met guidelines amounts for fruit and vegetables, however they had the highest intakes of fast food, hot chips, and soft drinks, in comparison to females of any other age. Red meat was most commonly consumed at 3-4 times a week, and chicken and processed meat at 1-2 times per week. This survey did not identify vegetarians, and dietary habits are likely to have changed since this data was collected (20).

The current dietary habits of vegetarian adolescent females in New Zealand are unknown. It is unclear how their dietary habits differ from that of their non-vegetarian counterparts outside of the exclusion of flesh-based foods. It is unknown whether the modern vegetarian diet in this population remains more healthful than an omnivorous diet. This study will contribute to the limited pool of research in adolescent vegetarians globally, in addition to updating current data on dietary habits in the adolescent female population in New Zealand.
The aim of this study was to investigate the frequency of intake of: protein-rich foods; fruit and vegetables; and discretionary foods among adolescent female vegetarians, and compare these with non-vegetarian adolescents.
2. Literature Review

2.1 Defining Dietary Habits

A habit is defined as “a settled or regular tendency or practice, especially one that is hard to give up” (21). Any behaviour performed routinely by an individual is by nature habitual, and any behaviour that relates to food and beverage intake can be considered a dietary habit. Portion size, timing, frequency of consumption, food groups, and other variables relating to food and beverage intake can all be relevant when looking at dietary habits (22). Dietary habits can be summarised as “behavioural eating patterns that become an automated response after repeat performances, triggered by situational cues” (23, 24). As the nature of the definition suggests, dietary habits form an integral part of an individual’s nutrient intake. They are intrinsically part of life, influencing what, when, and how, we eat and drink.

Dietary habits are a measure of diet quality. Diet quality is the extent to which a diet provides nutrients conducive to health. It can be measured on three levels: nutrients, foods and drinks, and dietary patterns (25). Previously in literature, diet quality has been measured in the form of nutrients, or dietary patterns (26). Nutrients are commonly represented by the relation of the nutrient to a health outcome, and given in grams. For example, iron and zinc intakes may be reported in a vegetarian diet where they are predicted to be sub-optimal (27). Dietary patterns are commonly represented by a score that measures the degree to which the dietary pattern has been met. For example, the Mediterranean diet is a healthful dietary pattern to which adherence can be measured with the Mediterranean diet score (28).
Dietary patterns are the sum of multiple dietary habits, and encompass an overall eating pattern and lifestyle. However, singular dietary habits which assess food and drink intake for comparison to dietary guidelines are rarely reported (29). Examining dietary habits around food and drink allows for an assessment of diet quality that is indicative of wider behaviours around nutrition, in a way that analyzing single nutrients or a whole dietary pattern cannot (30, 31). For example, takeaway consumption is a dietary habit that encompasses multiple foods and nutrients such as fat, salt, and sugar, as opposed to looking solely at any one of these nutrients or looking at the overall dietary pattern. By examining diet quality this way, the diet is represented holistically, and our understanding of the individual’s day to day singular behaviours around nutrition can be better understood (29).

2.1.1 Why are dietary habits important?

Dietary habits practiced in adult life are largely formed during childhood. During adolescence, as our autonomy over food choice increases, these dietary habits may change to become more healthful or unhealthful (13, 32). It is common for food behaviours in adolescence to become engrained and progress into adulthood (13, 18, 33, 34). Given this, nutrition in adolescence is predictive of disease risk as we age. For example, predisposition to cardiovascular disease (CVD) risk factors such as weight gain, hypertension, and metabolic syndrome can all be influenced by unfavorable dietary habits in adolescence (18). For this reason, it is important to identify unhealthful behaviours early to mitigate negative health outcomes later in life.
Traditionally, much of the literature has focused on individual nutrients and their relation to a specific health outcome (35, 36). Whilst this has made a valuable contribution to our understanding of nutrition and disease today, it has limitations because people do not, and cannot, eat nutrients in isolation (30). In New Zealand, the Ministry of Health have compiled our National Eating and Activity guidelines based on dietary habits that are conducive to health. Assessing dietary habits can provide valuable data that can be compared to these recommendations to identify issues of nutritional concern (29, 37). For example, the ANS identified that only 61.5% and 65% of females aged 15-18 years met the recommended serves per day for vegetables and fruit respectively. Furthermore, 17.2% had takeaways and 40% had sugary drinks 3 or more times per week (19). This prompted recommendations in the most recent review of national nutrition guidelines for young people around limiting takeaways and sugary beverages (38).

At an individual level, dietary habits recommendations are more likely to be adopted than individual nutrient recommendations (31). Because dietary habits are food-based (as opposed to nutrient based), they more closely mirror that of the real world. People eat food, not nutrients, therefore dietary habit recommendations are easier for individuals to translate into their own diet (30). This is as opposed to recommendations that stem from single nutrient studies (26, 37). For example, the DASH diet is a dietary pattern intervention that has proved more effective at lowering blood pressure than single nutrient supplementation (37).
Dietary habits encompass multiple foods and nutrients and can therefore be more representative of diet quality than individual nutrients. They are used to inform national recommendations consisting of food and food groups and are generally easily understood by the public. It important to assess dietary habits from an early age to identify unhealthful behaviours, particularly in populations at risk of nutritional issues. Research has shifted from a traditional focus on single nutrients or food groups to dietary habits and diet quality because of this (31).

2.1.2 How are dietary habits measured?

2.1.2.1 Food frequency questionnaires

Dietary habits are typically measured by Dietary Habits Questionnaires (DHQs) (39). DHQs are slight variations on food frequency questionnaires (FFQs) (22). FFQs assess frequency of consumption of foods through asking how often a food is consumed over a specified time period (40, 41). The distinction between FFQs and other dietary assessment methods is that FFQs obtain data that is subjective and representative of ‘usual’ intake. This is as opposed to measuring nutrient intake directly, such as in other dietary assessment methods that require keeping a record of foods eaten and weighed amounts (40). The purpose of FFQs can be to focus on intake of specific nutrients or foods, dietary risk factors for disease, or general measures of diet quality, such as intake of the food groups (40). When assessing dietary habits, the purpose and outcome measures desired are often similar to that generated by an FFQ. DHQs are simply FFQs that have been modified to include dietary habits questions in addition to food frequency questions.
2.1.2.2 Dietary habits questionnaires

Dietary habits questionnaires assess habitual intake of certain food groups, food preparation, cooking practices, and eating patterns, which may indicate compliance with dietary guidelines (22). DHQs are not required to ask frequency of consumption, but can be supplementary to frequency questions e.g. do you remove the skin from chicken before cooking? They may also be worded to determine if specific food items are chosen over others e.g. wheat over white bread, or may encompass multiple foods or behaviours e.g. takeaways or snack consumption. DHQs are typically used to compare dietary habits of interest between two populations, or rank individuals within a population by intake of food groups, nutrients, or other diet quality measures (33).

2.1.3 Dietary habits in New Zealand

In the general healthy New Zealand population, there is little literature investigating dietary habits as a primary outcome. To the best of my knowledge, most studies in the last decade investigating dietary habits in New Zealand have focused on the development and validation of FFQs or DHQs to assess dietary habits or nutrient intakes, as opposed to quantifying dietary habits in a population (22, 23, 29, 33, 42-44). Because of this, little is known about the dietary habits of New Zealanders.

Although not a direct assessment of dietary habits, a recent study by Maclaran et al (20) investigating the prevalence of dietary patterns in New Zealand identified a flexitarian diet was one of six prominent dietary patterns among New Zealand adults. This diet was based on the irregular or non-consumption of meat and included both strict and flexible followers. Interestingly, this group restricted other food groups outside of animal products, such as
dairy, oils, confectionary, soft drinks, and takeaways. A greater percentage of females than males were represented in this dietary group.

The ANS is New Zealand’s most recent nutrition survey and although outdated, is the most recent source of dietary habits of New Zealanders aged 15+ (19). Prior to this, was the National Nutrition Survey in 1997. The ANS focused on intakes of animal products, saturated fats, and salt. Contrasting to Maclaran et al, it was identified that among females aged 15-18 years, the relative majority consumed red meat 3-4 times a week, and chicken and processed meats 1-2 times a week. Furthermore, 90% of females aged 15-18 years consumed dairy milk. Intakes of vegetarian protein alternatives were not assessed in the ANS.

The differential findings between Maclaran et al and the ANS, although limited and unable to be directly compared due to population differences, are suggestive dietary habits in New Zealand have changed in the last decade. These changes are indicative of a reduction in animal food intake. This is plausible given that vegetarianism is a dietary pattern that is becoming increasingly common worldwide, particularly in developed countries (1). In New Zealand, the prevalence of vegetarianism is estimated to be 10.3% in those aged over 14 years (12). The same study reported a prevalence of 8.1% in 2011. Furthermore, prevalence of vegetarianism in New Zealand is highest in those aged 14-24 years at 13.3% and those aged 25-34 years at 13.8% (12). Women were found to be more likely to be vegetarian than men at 11.3% vs 9.3%. This is supportive of findings by Maclaran et al.
and provides further evidence that updated information around dietary habits among vegetarians, particularly in young females, is needed in New Zealand. Given the lack of previous information in this area and the dietary trend of reducing meat intakes, focusing on intakes of vegetarian protein alternatives in the New Zealand female population, may be an area of interest that warrants investigation.

2.2 Defining Vegetarianism

Vegetarianism is typically defined by the exclusion of flesh-based animal foods from the diet. However, there are multiple subcategories that exist within vegetarianism, relating to the extent of exclusion of animal foods from the diet (1, 45). For example, veganism is a subtype of vegetarianism that is typically characterised by the exclusion of all animal products from the diet (1). However, defining vegetarianism is further complicated as it cannot be assumed that individuals who report vegetarianism consistently avoid animal foods. Some vegetarians include small amounts of flesh-based foods, whereas other vegetarians exclude flesh foods but include other animal foods to varying degrees (17, 45). These complexities must be taken into account when interpreting literature in this area.

Globally, the majority of literature investigating vegetarianism uses cohort data from two large prospective studies; EPIC-Oxford (46) and the Adventist Health Study-2 (AHS-2). (47). Given this, the definitions of vegetarians used in these studies are the most commonly accepted.

The AHS-2 (47) defines vegetarianism using 5 categories: vegans, lacto-ovo vegetarians, pesco-vegetarians, semi-vegetarians, and non-vegetarians. The definitions for these are as
follows: vegans consume animal products less than once per month; lacto-ovo vegetarians consume dairy/eggs once a month or more but red meat, fish and poultry less than once a month, pesco-vegetarians consume fish, milk/ eggs once a month or more but red meat and poultry less than once a month, semi-vegetarians consume animal products once a month or more but no more than once per week. Non-vegetarians (omnivores) consume animal products more than once a week. When interpreting literature from the AHS-2, it is important to note that adventists adopt a vegetarian diet, in addition to many other healthful lifestyle behaviours, as part of their religion. There is a positive relationship between religion and health that is independent of any lifestyle factors (48). Adventists are therefore not representative of the general population (17); however studies using this cohort are still useful to offer insights into vegetarianism.

EPIC-Oxford were less flexible in their definitions. Participants self-reported to be meat eaters, fish eaters (eat no meat except fish), vegetarians (eat no meat or fish but eat dairy/eggs), or vegans (eat no animal products) (46). Similar to the AHS-2, some studies using the EPIC-Oxford cohort have categorised participants based on their answers to an FFQ e.g. regular meat eaters (>50g meat/day), low meat eaters (<50g meat/day), poultry-eaters, fish-eaters, vegetarians, and vegans (10) . Both EPIC-Oxford and the AHS-2 accounted for duration of adherence to these dietary patterns (46, 48).

There are also other terms in the literature such as flexitarian, which can be likened to a semi-vegetarian in definition, lacto-vegetarians and ovo-vegetarians which consume only dairy and only eggs (with the exclusion of all meats) respectively, and pollo-vegetarians which consume only chicken (with the exclusion of all other meats) (1). These categories
are often combined to all be considered ‘vegetarian’ due to small sample sizes in many vegetarianism studies (16).

2.2.1 Vegetarianism and health

Vegetarianism has historically been adopted for the health benefits it can confer, above and beyond that of an omnivorous diet (3, 4). Animal-welfare and environmentalism provide additional reasons for adoption of this dietary pattern (2, 4). Studies have typically investigated vegetarianism in relation to health outcomes (3, 4, 49-57). Risk of mortality, hypertension, metabolic syndrome, heart disease, stroke, and diabetes are lower among vegetarians compared to non-vegetarians (3, 4, 48, 55, 58). Researchers have also found that vegetarians have on average 12% lower LDL cholesterol concentrations and a mean of 1 mmHg lower systolic blood pressure in comparison to non-vegetarians (51). Conversely, a western dietary pattern which involves high intakes of foods containing fat, sugar, and salt, is associated with increased weight gain and risk of cardiovascular disease, type 2 diabetes, and cancer, as well as other nutritional issues (59, 60).

A randomised controlled trial investigating the effect of a 12 week low fat vegan diet intervention on adult New Zealanders was successful in reducing weight, BMI, HbA1c and cholesterol concentrations (61). At 6 months, the intervention group lost 10.6 kg more than the control group who received standard medical care. Furthermore, BMI decreased by 3.9 points, and HbA1c by 5mmol/mol in the intervention group. At 3 months, there were also greater reductions in total blood cholesterol (0.7 mmol/L) in intervention than control. The intervention involved education on how to follow a healthful vegan diet and participants
were advised to eat ad libitum with no exercise encouraged. Vegetarian diets are known to be lower in calories (62, 63), so the mechanism for these health benefits may be the consumption of low energy dense foods. However the mean energy intake of the control and intervention groups were not specified. It is also possible that increased healthful dietary behaviours typically associated with vegetarianism such as reduced fast food and increased fruit and vegetable consumption conferred health benefits (17). However as no dietary habits of the intervention population were studied, it is impossible to say.

2.2.2 Dietary Habits among Vegetarians

2.2.2.1 Vegetarians and protein sources

Globally, the limited literature investigating vegetarians has had consistent findings when comparing dietary habits of vegetarians to that of omnivores. Most studies focus on dietary habits around protein alternatives to flesh based animal foods, as these define the cornerstones of vegetarianism and are most likely to cause nutritional issues (9).

Bradbury et al concluded that vegetarians on average consume less of their total energy intake from high protein foods when compared to non-vegetarians (around ¼ compared to 1/3 in non-vegetarians) (11). This is consistent with a finding by Papier et al (10), who concluded that vegetarians do not completely replace meat with non-meat protein sources or high-protein plant-sources but instead increase their consumption of a large variety of plant-based-foods. These studies both found that vegetarians consumed higher amounts of soy, legumes, pulses, nuts and seeds, and lower amounts of animal based protein foods than non-vegetarians. Despite this, vegetarians overall were found to have lower total protein
intakes in comparison to non-vegetarians, and these intakes were predicted to be inadequate (10, 11). These studies were both on populations in the United Kingdom, however these findings have been confirmed in the French (16) and Finnish population (64).

As New Zealand has no updated studies on dietary habits, it is unknown what types of, and in what amount, protein containing foods are being consumed by individuals who are adopting vegetarianism i.e. the adolescent and young female population. As animal-based protein foods in the diet provide many nutrients conducive to health, the vegetarian diet needs to be well-planned to ensure excluded foods are replaced with vegetarian alternatives in sufficient quantities (9). This is an area that warrants investigation in New Zealand vegetarians.

2.2.2.2 Vegetarians and healthful habits

Several researchers in the United Kingdom (10, 11) found that vegetarians consumed higher amounts of fruit and vegetables, whole grains and unrefined carbohydrates, and lower amounts of fried foods, refined grains, alcoholic drinks, and sugary drinks than non-vegetarians. Likewise, research conducted in France (16) and Finland (64) report a higher consumption of cereals, grains, vegetables, and fruits among vegetarians. Intakes of discretionary foods and fruit and vegetables provide a marker for healthful dietary habits (32, 65). In the majority of the healthy population prolonged high intake of discretionary foods and low intake of fruits and vegetables is likely more detrimental to health than predicted suboptimal protein food intakes. For this reason, despite low protein intakes,
multiple studies still conclude that vegetarianism is overall a more healthful diet, and is more likely to meet nutritional guidelines, than an omnivorous diet (1, 10, 11, 16).

2.2.3 Modern day vegetarianism

A well-planned vegetarian diet is one that replaces excluded foods with appropriate alternatives in sufficient quantities, or supplements if needed (9). If this is not done correctly, vegetarianism can result in inadequacies of some nutrients (1). As aforementioned, protein foods are commonly excluded in the vegetarian diet, and may not be being replaced with alternatives in sufficient quantities. Vegetarianism should not be a diet of exclusion, rather it should be viewed as substitution. However, increases in commercially produced vegetarian foods, in the context of an increasingly obesogenic food environment, may have resulted in a vegetarian diet that is markedly different from that consumed historically. Furthermore, a lack of awareness around how to adopt a healthful vegetarian diet can present issues (8).

Exclusion of protein foods is a defining dietary habit of vegetarianism and can lead to nutritional inadequacies. This is concerning given that this diet is most frequently adopted in adolescent females. Protein is needed for growth and repair of muscles and tissues, and for the production of enzymes and hormones, all of which are crucial in adolescence (1). Protein foods are also high in nutrients like iron, zinc, calcium, vitamin B12, and vitamin D (64, 66). The risk of nutritional deficiencies of these nutrients increases as the degree of exclusion of animal protein foods in the vegetarian diets increases, with vegans being at highest risk (9, 64). With the onset of menarche, adolescent females are already at increased
risk of iron deficiency even when following an omnivorous diet (13, 14, 27). Furthermore, vegetarians bone mineral content is approximately 4% lower than omnivores, which in combination with poor calcium intake and vitamin D status is a common risk factor for osteoporosis as a woman ages (3). Peak bone mass is determined in adolescence, so Vitamin D and calcium intakes need to be adequate during this period (67). It is well known that the food environment has changed to be increasingly obesogenic in the last 10 years (5, 6), and similarly the vegetarian diet has evolved (8). Given the nutritional consequences, it is concerning that dietary habits of the modern vegetarian, particularly in adolescents, are largely unknown.

2.3 Dietary habits of adolescents

An adolescent is defined as a person between the ages of 10 and 19 years (68). Diet during adolescence has both short and long term impacts on health, so it is crucial to have healthful dietary habits during this time. As aforementioned, in adolescence, nutrient and energy needs are increased to allow for growth and development (34). For this reason, this population is particularly at risk of nutritional inadequacies if nutrient intake is lacking. Despite this, adolescents are more likely than any other population group to have unhealthful dietary habits, including a high intake of fast foods (19, 69, 70). Dietary intake is hugely variable due to changes that occur during this period of life. Increased autonomy over food choices and disposable income, financial independence, moving out of home, influence by peers, and targeted marketing are just a few reasons why we see a shift towards unhealthful dietary habits in this group (71). The literature shows that adolescences as a population group are less likely to meet national dietary recommendations than any other
group (19, 72). As dietary behaviours during this time are likely to track into adulthood, this is concerning (34).

A systematic review conducted by Keats et al (13) on adolescent females found that less than half of girls sampled reported eating meat, poultry and fish. Two-thirds of girls reported daily consumption of grains, legumes and pulses, with around 1/3 of girls eating fruit and vegetables daily. This intake was reported insufficient to meet World Health Organisation (WHO) dietary guidelines. High intakes of fast foods, sweet and salty snacks and sugar sweetened beverages (SSBs) were common, with 20% of girls reported eating fast foods daily, and salty snacks and sweet snacks being consumed by 80% and 65% of girls, respectively, four to six times per week (13). This review was undertaken on adolescent females in low and middle income countries, however these habits are typical of a western dietary pattern that is known to be true in high income countries, such as New Zealand (60, 73).

2.3.1.1 Dietary habits of adolescents in New Zealand

In New Zealand, the ANS observed similar findings to Keats et el. Seven percent, 17.2% and 39.6% of adolescent females respectively had hot chips, takeaways, and sugary drinks 3 times or more a week (19). This is in comparison to the total population at 7.5%, 5.8%, and 23.7% (19). A more recent study in New Zealand identified that only 3% of adolescents met recommended serves per day across the 4 food groups, with servings of snack foods per day exceeding that of vegetables and fruits. Furthermore, the median intake for milk at 250 ml per day matched that of sweet drinks (74). It should be noted that participants in this study were obese, with an ethnic profile of 45% Māori, an average age of 10 years, and
included both females and males. Therefore, these results are not generalisable to the New Zealand female adolescent population.

Aside from these studies, the literature in New Zealand is limited around dietary habits of adolescents, specifically females. The majority of studies conducted in this population in New Zealand either investigate diet and measures of body fat (60, 69), or have developed adolescent specific diet quality indices (22, 29, 33, 42). These studies do not measure dietary habits as a primary outcome.

2.3.2 Dietary habits of adolescent vegetarians

The literature on adolescent vegetarians, and specifically adolescent female vegetarians, is very limited. To the best of my knowledge, the only study on adolescent vegetarians was conducted in the United States (18). They concluded that compared to non-vegetarians, vegetarians consumed half a serving more of fruits, 1 serving more of vegetables and over one serving more of nut/nut butters and meat alternatives such as legumes (18). Vegetarians also consumed significantly less sugary beverages. No vegetarian participants in this study met dietary recommendations for poultry, eggs, or fish, however the majority of vegetarians met recommendations for legumes, dairy, nuts, and soy products. It is important to note that this study was conducted in a population of Adventists, which as aforementioned, may mean results are not able to be generalised to other populations.

In New Zealand, to the best of my knowledge, there has only been one study conducted on the dietary habits of vegetarians. This was prior to the year 2000, again, in a population of
adult Adventists (53). Outcome measures evaluated were vitamin, mineral and lipid levels, as opposed to dietary habits.

### 2.4 Conclusion and rationale for research

It is of importance to examine the dietary habits of adolescent New Zealanders, as they are likely to have changed in the last decade, with a higher prevalence of alternative dietary patterns such as vegetarianism. There is little known in New Zealand about the dietary habits of vegetarian adolescents, how their diet differs from that of omnivores outside of the exclusion of flesh-based animal foods, and if their diet is more healthful than an omnivorous diet. Although it has been proposed globally that protein containing foods are suboptimal in this group, this has not been investigated in adolescents in New Zealand. It is also unknown if unhealthful dietary habits that are characteristic of the modern adolescent e.g. high intakes of discretionary foods and low intakes of fruit and vegetables, are true if a vegetarian diet is being followed. The current study was conducted to investigate dietary habits of vegetarian and non-vegetarian adolescent females. This study focuses on both animal and plant based protein-rich foods (i.e. vegetarian meat alternatives, dairy, and eggs), and general markers of healthful and unhealthful behaviours such as fast foods, SSBs, snacks, and fruit and vegetable intakes. Frequency of consumption of these dietary habits will be assessed in both vegetarian and non-vegetarian populations to allow for comparison.
3. **Objective Statement**

The aim of this study was to investigate the frequency of intake of: protein-rich food groups; fruit and vegetables; and discretionary foods among adolescent female vegetarians, and compare these with non-vegetarian adolescents.

The objectives of this study are:

1. To determine frequency of intake of animal and plant based protein-rich foods in adolescent vegetarians, and compare this to non-vegetarians
2. To compare frequency of intakes of high fat, sugar, salt discretionary foods including takeaways/ fast foods, sugary beverages, confectionary, and snack food intakes between vegetarians and non-vegetarians.
3. To compare the percentage of vegetarians and non-vegetarians who are meeting national recommendations for fruit and vegetable intake.
4. Methods

4.1 Study design

This study was a cross-sectional, observational survey in adolescent females aged 15-18 years that attended high school in New Zealand. It was conducted over a one-year period with data collection being undertaken in 13 schools across eight locations throughout New Zealand, and targeted recruitment of vegetarians in Dunedin. Data were collected by Master of Dietetic students, and schools were selected based on the availability of data collectors, therefore this is a convenience sample, and the resulting data was clustered in relation to the schools (with the exception of the targeted recruitment data). Consideration was given to gather a spread of schools throughout New Zealand e.g. in both the North and South Island, however some locations have had multiple schools recruited e.g. Whangarei, Wellington, and Dunedin. Targeted recruitment of adolescent female vegetarians took place after the first three months of data collection revealed low enrolment numbers of vegetarians through the school based recruitment system.

Outcomes of the study included dietary intake and biochemical status of select nutrients; dietary habits; attitudes and beliefs around food choice; 24 hour activity patterns; and weight loss intentions and methods. The focus of these measures was to compare these outcomes between adolescent females who identified they follow a vegetarian diet to those who were non-vegetarian. The outcomes which were examined in this thesis were dietary habits of vegetarian and non-vegetarians, specifically animal and plant based protein foods, discretionary foods, and fruit and vegetables. The present study only analysed data of participants who completed the DHQ.
4.1.1 Ethics

This study was approved by the University of Otago Human Ethics Committee (Health) (H19/004) (Appendix A), and the Ngāi Tahu Research Consultation Committee (Appendix B). The study was registered with the Australian New Zealand Clinical Trials Registry (ACTRN12619000290190). All subjects provided online informed consent prior to being enrolled in the study (Appendix C). For participants under the age of 16 years obtained online informed consent was also obtained from their parents or legal guardians.

4.2 Participants

4.2.1 Inclusion and exclusion criteria

Individuals who self-identified as female and were between 15 and 18 years of age, who were enrolled in one of the recruited high schools, who were able to speak and understand English, and able to complete the required online questionnaires were eligible to participate. In addition, females aged 15-18 years who identified as vegetarian living in Dunedin were also eligible for recruitment.

Participants were excluded if they knew they were pregnant. Individuals under the age of 16 years who could not obtain online consent from parents or caregivers were excluded.

4.2.2 Recruitment

Recruitment of schools began in November 2018 and concluded in August 2019. Participant recruitment and data collection took place from February- April 2019 and July-September 2019 to coincide with term one and term three of the school year.
4.2.3 School Recruitment

Recruitment was both school-based and targeted. Schools were invited to participate based primarily on the convenience of their location to data collectors, secondly by decile, and thirdly by roll number. Schools with a lower decile, and greater than 400 students total or 200 girls were given preference. Initially, study coordinators sent invitations by email to the schools, with the first invites being sent from November 2018. Data collection was to be performed by pairs of Master of Dietetic students, and invitations were sent to three schools per pair. In some cases, there were multiple pairs of students in one centre (e.g. there were two pairs of data collectors in Dunedin), so six schools were selected for initial invitation. The aim of school recruitment was to get one school per pair of data collectors. If schools did not respond, study coordinators followed up with an email or phone call. If a second round of recruitment was needed, higher decile and lower roll schools were invited to participate. Following this, if schools were still required in certain locations, they were recruited through other means such as recruitment visits from data collectors, or the university liaison officers utilising known points of contact at schools in the required locations.

Thirteen schools were recruited in total, which was less than the required 14 schools, however targeted recruitment of vegetarians in Dunedin took the place of one school. The school locations were Dunedin, Wellington, Christchurch, New Plymouth, Nelson, Whangarei, Tauranga, and Wanaka. Seven schools were recruited through initial email and phone contact of schools selected by higher roll number (Columba, Hornby, Kaikorai Valley, Mt Aspiring, Mt Maunganui, Spotswood, Whangarei Girls). Six schools (Bayfield,
Kapiti, Queens, St Catherine’s, Tauraroa, Waimea) were recruited through other means. Once schools registered their interest through responding to the aforementioned recruitment requests, they were contacted to arrange dates and times for participant recruitment and data collection to begin in the schools.

### 4.2.4 Participant recruitment

The flow of participants through the study is shown in Figure 4.1. Data collection in the schools began with participant recruitment. Participants were recruited by data collectors entering the school and screening an informational video about the study. Participants were also provided with an information sheet (Appendix D). The video was screened via a whole school assembly, year group assembly, or specific classes, dependent on the preference of the school. A short informative presentation about the study and what would be required of the participants was given by data collectors following the screening. Participants were informed they did not have to complete all components of the study to participate, as the study was broken up into different sections e.g. accelerometer, urine, blood, two 24 hour recalls, and questionnaires. However, completion of all components of the study was encouraged. An incentive to participate in the study was offered at this time, with a total of $30 in grocery vouchers available per participant. These were broken into $5 vouchers for the completion of each section of the study.

If students were interested in the study, they could register their interest by recording their name, age, and email address with the data collectors after the in-school presentation. The option was also given to visit the SuNDiAL website (www.otago.ac.nz/sundial) where they
could read more information, re-watch the video, and re-read the information sheet. The website allowed recording of name, age, email address, and the high school of the participant. If the participant was under the age of 16 years, a parent or legal guardian’s email address was also requested along with the participants email address. After registering interest, the study coordinator assigned ID numbers to protect anonymity of the participants and emailed a link to the provided email with an enrolment questionnaire, containing consent (Appendix C).

4.2.5 Targeted recruitment

After the first six months of the study, targeted recruitment of vegetarians began in Dunedin due to low enrolment numbers of vegetarians. Adolescent females aged 15-18 years who identified as vegetarian were recruited through advertising in local papers and on social media. To register interest, participants were directed to the study website (www.otago.ac.nz/sundial) where they could view the aforementioned study video, read the information sheet, and provide their name, email address and age if wishing to participate. The same process was followed as school recruitment, in that a link to a questionnaire was emailed to obtain consent, and enrolment.
Figure 4.1: Participant recruitment and flow of participants through the study
4.3 Data collection

4.3.1 All measures

There were multiple outcomes in this study and therefore multiple measures, however because the present study focused on dietary habits, the most relevant measure is the Dietary Habits questionnaire. Several online questionnaires were administered. The first questionnaire was an enrolment questionnaire which collected consent, and information about demographics, vegetarian status, and health status. Participants self-reported in the enrolment questionnaire if they identified as being vegetarian. Once this initial questionnaire was completed, the participant was considered to be enrolled in the study. Subsequent questionnaires collected information about dietary habits, weight loss, and attitudes and motivations for food choice. Anthropometric measures were carried out at the individual’s school, or at the Student Dietitian clinic in Dunedin if the participants were targeted recruitment.

4.3.2 Vegetarian status

Vegetarian status was self-identified in the online enrolment questionnaire through a question asking, “Are you vegetarian or vegan?”, with yes or no as possible answers on a drop-down list. Similarly, the individual was then asked to identify if they were vegan. Follow on questions were then asked such as “which foods do you eat” and a drop-down list containing egg, cows milk, seafood, poultry, red meat, or none of the above. As many options as applicable were able to be selected. “How long have you been following this way of eating?” was also asked (Appendix E).
4.3.3 Demographics

Demographic variables were collected in the enrolment questionnaire (Appendix F). Variables collected were age, ethnicity, and NZ deprivation index category (NZDep). All variables were self-reported except for the deprivation index. Age was defined as age at enrolment in years.

Participants were assigned to ethnic groups based on the priority classification system defined by the Ministry of Health New Zealand (75). The prioritisation order from highest to lowest was: Māori; Pacific; Asian; and New Zealand European and others. For example, if a participant identified as both Māori and NZ European, they were classified as Māori. An NZDep score was assigned to each participant based on the participants reported address at enrolment. Participants were then categorised into low, moderate, or high deprivation based on their score. NZDep is a measure of socioeconomic deprivation in New Zealand, with the most recent data being available from 2013 (76). It measures eight variables of material and social deprivation of people in New Zealand, in small areas called meshblocks. Each meshblock is given a score between 1 and 10, with score 1 being least deprived and 10 being most deprived. This information can be presented in deciles from 1-10 with 1 being least deprived and 10 being most deprived, or can be categorised into low, moderate, and high deprivation. In the present study, NZDep information was presented in categories. Low deprivation was categorised from an NZDep 2013 score of 1-3, moderate deprivation from a score of 4-7, and high deprivation from a score of 8-10.
4.3.4 Anthropometrics

Anthropometric measures recorded were height and weight, from which body mass index was calculated. Trained data collectors took these measures in duplicate at the first appointment with the participant. Data collectors were supplied with standardised protocols which are based on published and widely accepted practice (Appendix G).

Standing height was measured using a stadiometer (Seca 213 or Wedderburn). Weight was measured using electronic scales (Medisana PS420, Salter 9037 BK3R, Seca Alpha 770, or Soehnle Style Sense Comfort 400) that were calibrated by the research team.

BMI Z-scores were calculated from the participant’s height and weight using the WHO child growth standards as the reference (77). From the BMI Z-score, participants were categorised into weight categories of healthy, overweight, or obese.

4.3.5 Dietary habits questionnaire

Dietary habits were measured using the SuNDiAL DHQ (Appendix H). The questionnaire was administered via a link sent to emails of participants after enrolment had been completed. The questionnaire was able to be saved and resumed at a later time if the participant needed.

The questionnaire was modified from the ANS DHQ. The ANS DHQ was not validated, however it was cognitively tested in a sample of 30 Adult New Zealanders. Similarly, the SuNDiAL DHQ was not validated as it was beyond available resources to do so. However as recommended by previous research, the questionnaire was specifically designed for the population of use. It incorporated an updated food list of commonly consumed foods in
New Zealand adolescents, and vegetarian protein sources (41, 78) which were not present in the ANS DHQ.

The SuNDiAL DHQ contained 49 questions on foods and dietary habits, with an additional section on supplement use which asked three questions per supplement taken. The present thesis analysed 23 of these questions, which were based around flesh-based animal foods, dairy, eggs, vegetarian meat alternatives, discretionary foods, and fruit and vegetables. One question around bread intake was also included in the analysis.

Participants reported frequency of intake of a food item using a drop-down list. Nine possible frequency of intake options were available to select from. This provided more options for the participant and therefore more specificity of the questionnaire, in comparison to the seven frequency options that were used in the ANS. It is of note that the recall period was not specified in the SuNDiAL DHQ, whereas in the ANS DHQ, it was recommended participants recall the previous four weeks prior to answering.

Possible frequency options given ranged from ‘never’ to ‘more than 3 times per day’ or ‘more than 3 serves per day’ in the case of fruits and vegetables. Serving sizes were provided by descriptions of a standard serving e.g. “A serving is the same as a medium piece of fruit like an apple”. If a specific type of a food chosen e.g. wholegrain vs white bread, made a difference to its nutritional content, it was asked to be specified e.g. bread, milk, and spread questions asked for both frequency and type.
The questionnaire included eight overarching food groups: fruits and vegetables (2 questions), milk and other dairy (6 questions), bread (2 questions), spreads and oils (2 questions), nuts and nut butters (15 questions), meat (6 questions), eggs (1 question), and vegetarian meat alternatives (5 questions). Dietary habits questions asked around discretionary foods (9 questions) such as sweet drinks, high fat, sugar, salt snack foods, confectionary, takeaways and fast foods, in addition to a question on breakfast eating. As the present study focused on animal and plant-based protein foods, discretionary foods, and fruit and vegetables, only a select few of these food groups and questions were analysed.

4.4 Data analysis

4.4.1 Sample size

Assuming a design effect (for school clusters) of 1.5 and a prevalence of vegetarianism of 20%, n=297 participants were needed to detect a difference of 0.5 SD with 80% power to the 5% significance level. Recruitment was limited to the 2019 school year and participant numbers were maximised where possible.

4.4.2 Statistical analysis

The coding and preliminary cleaning of all data from questionnaires used in this study (enrolment questionnaire and dietary habit questionnaire) were completed by Dr Jill Haszard, a biostatistician within the Human Nutrition Department at the University of Otago. All data was interpreted with use of a codebook and data dictionary.
4.4.2.1 Vegetarian status and demographics

Prevalence was calculated for age, ethnicity, NZDep, and vegetarianism.

4.4.2.2 Anthropometrics

Weight categories were calculated from BMI z-scores as follows. Healthy weight was defined as a Z-score of -2 to +1; overweight as from >+1 to ≤+2, and obese as >+2. No participants were classified as underweight (Z-score < -2) in this study.

To demonstrate consistency between data collectors in the measurement of anthropometric measures in the SuNDiAL study, an inter-rater reliability study was carried out before the study started. Twenty-seven of the 30 data collectors took part in this assessment. Twelve girls (convenience sample) between the ages of 15 and 18 gave consent to have their height, weight, and ulna length measured. Each data collector measured four girls twice. These repeats were not successive and data was recorded on a fresh page for each repeat. A standard protocol was provided to all data collectors. Measurements were not to be read out loud. Inter-rater reliability was assessed using mixed effects intra-class correlation coefficients (ICC).

The ICC for weight was 1.00; the ICC for height was 0.92; and the ICC for ulna length was 0.86. All ICC indicated excellent agreement between data collectors. Of note, variation in measures for height were greatest when measuring the tallest girls, suggesting that more care may be needed when measuring taller girls. In response to this, a step stool was provided to all data collectors and instructions to use safely when needed.
4.4.2.3 Dietary habits questionnaire

Descriptive analysis was performed using Excel (version 16.3). Nine frequency of response options from the DHQ were combined to form five categories. However analysis and presentation of the data differed depending on what foods were being analysed and how the data was best able to be understood.

For the tables ‘Comparison between frequency of intake of protein foods in vegetarians and non-vegetarians’ and ‘Comparison between frequency of intake of discretionary foods in vegetarians and non-vegetarians’, data was combined to form five categories; exclude or rarely have, 1-3 times a month, weekly, 2-6 times a week, once or more a day. For the table ‘Comparison between fruit and vegetable intake in vegetarians and non-vegetarians’, data was combined to form five categories, however because this information was specified in serving sizes, these categories were as follows: less than 1 serving a week, 1-4 servings a week, 5 servings a week-daily, 2 servings a day, 3 or more servings a day.

Prevalence was calculated for each specified frequency of consumption category for both vegetarian and non-vegetarian data using Excel. Confidence intervals for the prevalence were calculated using STATA/version 12 (Stata Corp. Stata Statistical Software: Release 12. Texas). All confidence intervals given were calculated at 95%. Comparisons between vegetarians and non-vegetarians were performed by inspecting the confidence intervals and using clinical judgement to report any meaningful differences.
5. Results

5.1 Demographic characteristics

Participant demographics are presented in Table 5.1. Two hundred and forty eight participants completed the Dietary Habits Questionnaire. Thirty-three of these participants identified as vegetarian and 215 identified as non-vegetarian. The age range of participants was 15 to 18 years on enrolment into the study, with a mean and standard deviation (SD) of 16.8 (0.9) years. Vegetarians were slightly older than non-vegetarians, with 75.7% being 17-18 years old compared to 59.5% of non-vegetarians. Of total participants who completed the DHQ, 58.9% had a BMI z-score in the healthy range. There was a slightly higher prevalence of those with a healthy bodyweight among vegetarians (66.7%), compared to non-vegetarians (57.7%). Vegetarians also had a lower prevalence of overweight and obesity. Participants were predominantly of New Zealand European or ‘other’ descent. There was a higher proportion of Māori in the vegetarian group (24.2%) compared to the non-vegetarian group (12.0%). Most participants were categorised into moderate deprivation (46.4%), with prevalences of participants in a deprivation category being similar between vegetarian and non-vegetarians.
Table 5.1: Demographic characteristics of Dietary Habits Questionnaire participants

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Participants (n=248)</th>
<th>Vegetarian (n=33)</th>
<th>Non-vegetarian (n=215)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age, n (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>23 (9.3)</td>
<td>1 (3.0)</td>
<td>22 (10.2)</td>
</tr>
<tr>
<td>16</td>
<td>72 (29.0)</td>
<td>7 (21.2)</td>
<td>65 (30.2)</td>
</tr>
<tr>
<td>17</td>
<td>95 (38.3)</td>
<td>18 (54.5)</td>
<td>77 (35.8)</td>
</tr>
<tr>
<td>18</td>
<td>58 (23.4)</td>
<td>7 (21.2)</td>
<td>51 (23.7)</td>
</tr>
<tr>
<td><strong>Ethnicity, n (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NZEO</td>
<td>200 (80.6)</td>
<td>25 (75.6)</td>
<td>175 (81.4)</td>
</tr>
<tr>
<td>Maori</td>
<td>34 (13.7)</td>
<td>8 (24.2)</td>
<td>26 (12.0)</td>
</tr>
<tr>
<td>Asian</td>
<td>9 (3.6)</td>
<td>0</td>
<td>9 (4.2)</td>
</tr>
<tr>
<td>Pacific</td>
<td>5 (2.0)</td>
<td>0</td>
<td>5 (2.3)</td>
</tr>
<tr>
<td><strong>Weight status, n (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Healthy</td>
<td>146 (58.9)</td>
<td>22 (66.7)</td>
<td>124 (57.7)</td>
</tr>
<tr>
<td>Overweight</td>
<td>52 (21.1)</td>
<td>5 (15.1)</td>
<td>47 (21.9)</td>
</tr>
<tr>
<td>Obese</td>
<td>24 (9.7)</td>
<td>2 (6.1)</td>
<td>22 (10.2)</td>
</tr>
<tr>
<td>Missing data</td>
<td>26 (10.5)</td>
<td>4 (12.1)</td>
<td>22 (10.2)</td>
</tr>
<tr>
<td><strong>NZDep, n (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low deprivation</td>
<td>89 (35.9)</td>
<td>13 (39.4)</td>
<td>76 (35.3)</td>
</tr>
<tr>
<td>Mod. Deprivation</td>
<td>115 (46.4)</td>
<td>15 (45.5)</td>
<td>100 (46.5)</td>
</tr>
<tr>
<td>High deprivation</td>
<td>43 (17.3)</td>
<td>5 (15.2)</td>
<td>38 (17.7)</td>
</tr>
<tr>
<td>Missing data</td>
<td>1</td>
<td>0</td>
<td>1 (0.4)</td>
</tr>
</tbody>
</table>

1. Weight status was calculated from the World Health Organisation Child BMI z-scores (77). Healthy weight was defined as a Z-score of -2 to +1; overweight as from >+1 to ≤+2, and obese as >+2.
2. Low deprivation was categorised as a NZDep2013 score of 1-3, moderate deprivation was a score of 4-7, and high deprivation was 8-10.
3. Abbreviations: n= number, NZDep= New Zealand Deprivation Index, Mod=moderate, NZEO= New Zealand European/Other
5.2 Self-reported prevalence of animal derived foods in the diet of vegetarians

In the enrolment questionnaire, vegetarians were asked to identify which animal derived foods they included in their diet. A visual representation of this can be seen in Figure 5.1. All participants who included cow’s milk also included eggs, which is defined as a lacto-ovo-vegetarian. Of the vegetarians who included eggs, 31.8% excluded cow’s milk, which is defined as an ovo-vegetarian. Of the 24.2% that include fish or seafood (pescatarians) 25% of these also included chicken or poultry (pesco-pollo vegetarians). Of the total population (n=248), 13.3% of the participants identified as being vegetarian and were included in the vegetarian analysis.

Figure 5.1: Self-reported prevalence of animal derived foods in the diet of vegetarians
n=33 vegetarians
5.3 Animal based protein foods

5.3.1 Egg

The relative majority of vegetarians (39.4%, 95% CI: 21.8-57) rarely consume or exclude eggs. This is appreciably different to non-vegetarians at 11.6% (95% CI: 7.3-15.9). No vegetarians included eggs once a day or more. The plurality of non-vegetarians (35.8%) have eggs 2-6 times a week (Table 5.2)

5.3.2 Milk

When asked how often they consumed milk of any type i.e. cow or plant, the relative majority of vegetarians answered 2-6 times a week (36.4%) and plurality of non-vegetarians answered daily or more than once a day (41.4%) (Table 5.2).

When looking solely at cows milk intake, appreciably more vegetarians (66.7%, 95% CI: 49.7-83.6) exclude or rarely consume cow’s milk, compared to non-vegetarians (20.9%, 95% CI: 15.4-26.4) (Table 5.2). Among vegetarians, 15.1% consumed cow’s milk more than once a week, which is considerably less than non-vegetarians at 63.8%. Only 6% of vegetarians included cows milk once or more a day (Figure 5.2).

5.3.3 Dairy

For dairy sources other than cow’s milk i.e. cheese and yoghurt, the relative majority of vegetarians (48.5%, 95% CI: 30.5-66.5) answered they exclude or rarely consume dairy (Table 5.2). This is in comparison to 8.9% (95% CI: 15.4-26.4) of non-vegetarians. Only
42.1% of vegetarians have these foods more than once a week compared to 77.6% of non-vegetarians. Only 12.1% of vegetarians include dairy once or more a day (Figure 5.3)

When asked what milk type they consumed, 27.3% of vegetarians answered cows milk and 63.6% answered plant based milk (Figure 5.4a). This is in comparison to non-vegetarians of which 72.2% had cows and 17.2% had plant-based milk (Figure 5.4b).
Table 5.2: Comparison between frequency of intake of protein foods in vegetarians\textsuperscript{1,2} and non-vegetarians\textsuperscript{1,2}

<table>
<thead>
<tr>
<th>Questions</th>
<th>Exclude or rarely have</th>
<th>1-3 times a month</th>
<th>Weekly</th>
<th>2-6 times a week</th>
<th>Once or more a day</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often do you eat egg?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetarian</td>
<td>39.4 (21.8-57.0)</td>
<td>15.2 (2.2-28.1)</td>
<td>18.2 (4.3-32.1)</td>
<td>27.3 (11.2-43.3)</td>
<td>0</td>
</tr>
<tr>
<td>Non-vegetarian</td>
<td>11.6 (7.3-15.9)</td>
<td>17.7 (12.5-22.8)</td>
<td>27.9 (21.9-34.0)</td>
<td>35.8 (29.4-42.3)</td>
<td>7.0 (3.5-10.4)</td>
</tr>
<tr>
<td>How often do you have milk (cows or plant)?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetarian</td>
<td>15.2 (2.2-28.0)</td>
<td>6.0 (0-14.7)</td>
<td>15.2 (2.2-28.0)</td>
<td>36.4 (19.0-53.7)</td>
<td>27.3 (11.2-43.3)</td>
</tr>
<tr>
<td>Non-vegetarian</td>
<td>14.0 (9.3-18.6)</td>
<td>3.3 (0.9-5.6)</td>
<td>8.8 (5.0-12.7)</td>
<td>32.6 (26.2-38.9)</td>
<td>41.4 (34.8-48.0)</td>
</tr>
<tr>
<td>How often do you have cows milk?</td>
<td></td>
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</tr>
<tr>
<td>Vegetarian</td>
<td>66.7 (49.7-83.6)</td>
<td>6.0 (0-14.6)</td>
<td>12.1 (0.4-23.9)</td>
<td>9.1 (0-19.4)</td>
<td>6.0 (0-14.7)</td>
</tr>
<tr>
<td>Non-vegetarian</td>
<td>20.9 (15.4-26.4)</td>
<td>6.5 (3.2-9.8)</td>
<td>8.8 (5.0-12.7)</td>
<td>29.3 (23.2-35.4)</td>
<td>34.5 (28.0-40.8)</td>
</tr>
<tr>
<td>How often do you eat dairy products excluding milk?</td>
<td></td>
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<tr>
<td>Vegetarian</td>
<td>48.5 (30.5-66.5)</td>
<td>6.0 (0-14.7)</td>
<td>3.0 (0-9.2)</td>
<td>30.3 (13.8-46.9)</td>
<td>12.1 (0.37-23.9)</td>
</tr>
<tr>
<td>Non-vegetarian</td>
<td>8.9 (5.0-12.7)</td>
<td>7.0 (3.5-10.4)</td>
<td>6.5 (3.1-9.8)</td>
<td>46.0 (39.3-52.8)</td>
<td>31.6 (25.4-37.9)</td>
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</tbody>
</table>

Continued…
<table>
<thead>
<tr>
<th>Food</th>
<th>Vegetarian</th>
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<th></th>
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<th></th>
<th>Non-vegetarian</th>
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<tbody>
<tr>
<td>How often do you eat</td>
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<tr>
<td>Processed meat (e.g. ham,</td>
<td>97.0 (90.8-100)</td>
<td>0</td>
<td>3.0 (0-9.2)</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
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<tr>
<td>bacon, sausages, luncheon,</td>
<td></td>
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<tr>
<td>canned corned beef, pastrami,</td>
<td></td>
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<tr>
<td>salami)</td>
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</tr>
<tr>
<td>Vegetarian</td>
<td>8.4 (4.6-12.1)</td>
<td>14.9 (10.1-19.7)</td>
<td>17.2 (12.1-22.3)</td>
<td>48.8 (42.1-55.6)</td>
<td>10.7 (6.5-14.9)</td>
<td></td>
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</tr>
<tr>
<td>Non-vegetarian</td>
<td></td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>How often do you eat red</td>
<td>97.0 (90.8-100)</td>
<td>0</td>
<td>0</td>
<td>3.0 (0-9.2)</td>
<td>0</td>
<td></td>
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<tr>
<td>meat? (excluding processed</td>
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<td>meat)</td>
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</tr>
<tr>
<td>Vegetarian</td>
<td>6.1 (2.8-9.3)</td>
<td>8.4 (4.6-12.1)</td>
<td>13.5 (8.9-18.1)</td>
<td>52.6 (45.8-59.3)</td>
<td>19.5 (14.2-24.9)</td>
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<tr>
<td>Non-vegetarian</td>
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<tr>
<td>How often do you eat pork?</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetarian</td>
<td>26.0 (20.1-32.0)</td>
<td>33.5 (27.1-39.8)</td>
<td>26.5 (20.6-32.5)</td>
<td>13.5 (8.9-18.1)</td>
<td>0.5 (0-1.4)</td>
<td></td>
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<tr>
<td>Non-vegetarian</td>
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</tr>
<tr>
<td>How often do you eat poultry?</td>
<td>90.9 (80.6-100)</td>
<td>3.0 (0-9.2)</td>
<td>0</td>
<td>6.0 (0-14.7)</td>
<td>0</td>
<td></td>
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<tr>
<td>(e.g. chicken, turkey etc.)</td>
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</tr>
<tr>
<td>Vegetarian</td>
<td>2.3 (0.3-4.4)</td>
<td>8.8 (5.0-12.7)</td>
<td>21.9 (16.3-27.5)</td>
<td>61.4 (54.8-68.0)</td>
<td>5.6 (2.5-8.7)</td>
<td></td>
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</tr>
<tr>
<td>Non-vegetarian</td>
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</tbody>
</table>

Continued…
<table>
<thead>
<tr>
<th>How often do you eat fish?</th>
<th>Vegetarian</th>
<th>Non-vegetarian</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>69.7 (53.1-86.2)</td>
<td>6.0 (0-14.7)</td>
</tr>
<tr>
<td>How often do you eat other seafood/shellfish? (e.g. prawns, squid, crab)</td>
<td>Vegetarian</td>
<td>84.8 (71.9-97.8)</td>
</tr>
<tr>
<td>Non-vegetarian</td>
<td>66.0 (60-72.4)</td>
<td>24.7 (18.8-30.5)</td>
</tr>
<tr>
<td>How often do you eat lentils, chickpeas, kidney beans or baked beans e.g. legumes? (Do not include peas or peanuts)</td>
<td>Vegetarian</td>
<td>9.1 (0-19.4)</td>
</tr>
<tr>
<td>Non-vegetarian</td>
<td>37.7 (31.1-44.2)</td>
<td>33.0 (26.7-39.4)</td>
</tr>
<tr>
<td>How often do you eat tofu, tempeh and tofu products?</td>
<td>Vegetarian</td>
<td>27.3 (11.2-53.7)</td>
</tr>
<tr>
<td>Non-vegetarian</td>
<td>93.0 (89.6-96.5)</td>
<td>6.0 (2.8-9.3)</td>
</tr>
</tbody>
</table>

Continued…
<table>
<thead>
<tr>
<th>How often do you eat vegetarian ingredients (e.g. quorn, nut meat, vegetarian mince) that are used in other dishes?</th>
<th>Vegetarian</th>
<th>Non-vegetarian</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>36.4 (19-53.7)</td>
<td>36.4 (19-53.7)</td>
</tr>
<tr>
<td>How often do you eat vegetarian sausages, nuggets, patties etc?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetarian</td>
<td>45.4 (27.5-63.9)</td>
<td>21.3 (6.5-35.9)</td>
</tr>
<tr>
<td>Non-vegetarian</td>
<td>91.2 (87.3-95.0)</td>
<td>7.0 (3.5-10.4)</td>
</tr>
<tr>
<td>How often do you eat vegetarian &quot;meat alternatives&quot; (e.g. chicken-free chicken)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetarian</td>
<td>54.5 (36.0-72.5)</td>
<td>18.2 (4.3-32.1)</td>
</tr>
<tr>
<td>Non-vegetarian</td>
<td>95.8 (93.1-98.5)</td>
<td>1.9 (0-3.7)</td>
</tr>
</tbody>
</table>

1 All data is prevalence (95% Confidence Interval)
2 Vegetarian n=33, Non-vegetarian n=215
Figure 5.2: Prevalence of frequency of cows milk intake in vegetarians and non-vegetarians

Figure 5.3: Prevalence of frequency of dairy intakes in vegetarians vs non-vegetarians

1vegetarian n=33
2 non-vegetarian n=215
Figure 5.4a: Prevalence of plant-based and cows milk intakes in vegetarians\textsuperscript{1,2}

Figure 5.4b: Prevalence of plant-based and cows milk intakes in non-vegetarians\textsuperscript{1,2}

\textsuperscript{1}vegetarian n=33
\textsuperscript{2} non-vegetarian n=215
5.4 Flesh based protein foods

5.4.1 Processed and red meat

The majority of vegetarians (97.0%, 95% CI: 90.8-100) exclude or rarely consume processed meat and red meat. This was appreciably different to non-vegetarians, where processed meat was excluded by 8.4% (CI:4.6-12.1), and red meat by 6.1% (CI:2.8-9.3). The relative majority of non-vegetarians had processed (48.8%, CI: 42.1,55.6) and red meat (52.6%, 45.8-59.3) 2-6 times a week (Table 5.2).

5.4.2 Pork

All vegetarians (100%) identified they exclude or rarely have pork, which was markedly different to non-vegetarians at 26% (CI: 20.1-32.0). Most non-vegetarians (59.5%) had pork 3 times a month or less (Table 5.2).

5.4.3 Chicken and poultry

Of vegetarians, 90.6% (CI:80.6-100) never or rarely have chicken or poultry, which is considerably different to non-vegetarians at 2.3% (95% CI:0.3-4.4). Most non-vegetarians include poultry 2-6 times a week (61.4%) (Table 5.2)

5.4.4 Fish and seafood

Of vegetarians, 75.7% have fish less than 3 times a month, of which 69.7% (CI:53.1-86.2) exclude or rarely consume fish, and 6.0% (95% CI:0-14.7) consume 1-3 times a month. This is different to non-vegetarians, of which 27.9% (95%CI:21.9-34.0) exclude or rarely have fish, and 37.2% (30.7-43.7) have 1-3 times a month. The majority of vegetarians
(84.8%) and non-vegetarians (66.0%) exclude or rarely eat shellfish or other seafood (Table 5.2).

5.5 Vegetarian protein foods

5.5.1 Legumes

The majority of vegetarians (78.9%) have legumes more than once a week, with most having 2-6 times a week (57.6%, 95% CI: 39.8-75.4) (Table 5.2). Conversely, non-vegetarians were more likely to exclude, rarely eat, or consume legumes only 1-3 times per month compared to vegetarians. Legume intake was appreciably different between vegetarians and non-vegetarians across every frequency of intake (Figure 5.5).

Figure 5.5: Prevalence of frequency of legume intakes in vegetarians and non-vegetarians

1vegetarian n=33
2 non-vegetarian n=215
5.5.2 Tofu/tempeh

The relative majority of vegetarians eat tofu/tempeh 1-3 times a month (33.4%). Only 21.2% of vegetarians include tofu more than once a week. Tofu intake was appreciably different between vegetarians and non-vegetarians across several of the lower frequencies of intake, from rarely have or exclude, to weekly. It is of note that 93% (95% CI: 89.6-96.5) of non-vegetarians rarely have or exclude tofu compared to 27.3% (95% CI: 11.2-53.7) of vegetarians (Table 5.2).

5.5.3 Vegetarian ingredients

Among vegetarians, 72.8% had vegetarian ingredients i.e. quorn, nut meat, vegetarian mince, 3 times a month or less, with 36.4% of those rarely consuming or excluding these ingredients. This was different to non-vegetarians, of which 94.4% rarely had or excluded vegetarian ingredients. Similar to tofu, only 21.2% of vegetarians included these foods more than once a week (Table 5.2).

5.5.4 Vegetarian sausages, nuggets, patties.

The relative majority of vegetarians rarely consumed or excluded these foods (45.4%, 95% CI: 27.5-63.9). More non-vegetarians than vegetarians rarely had or excluded at 91.2% (95% CI: 87.3-95.0). Of vegetarians, 27.3% included these foods more than once a week, which was slightly higher than the inclusion of tofu, vegetarian ingredients, and meat alternatives (Table 5.2).
5.5.5 Meat alternatives

Most vegetarians exclude or rarely have meat alternatives and substitutes i.e. chicken-free chicken, with 72.7% consuming these 3 times a month or less. This was appreciably different to non-vegetarians at 97.7%. Of vegetarians, 21.2% included meat alternatives more than once a week (Table 5.2). 

5.6 Bread intakes

Vegetarians consumed bread less frequently than non-vegetarians. The majority (84.9%) of vegetarians included bread once a day or less, in comparison to 77.7% of non-vegetarians. Of vegetarians 12.1% rarely or never included bread, in comparison to 7.4% of non-vegetarians (data not shown).
5.7 Discretionary foods

5.7.1 Fizzy drinks

Of vegetarians, 87.9% consume fizzy drinks less than 3 times a month, with 75.8% (95% CI: 60.3-91.2) excluding or rarely having them (Table 5.3). Less non-vegetarians exclude or rarely have fizzy drinks in comparison to vegetarians (49.8%, 95% CI:43.0-56.5) (Figure 5.6).

Figure 5.6: Prevalence of frequency of intakes of Fizzy drinks in vegetarians and non-vegetarians.1,2
1 vegetarian n=33
2 non-vegetarian n=215
5.7.2 Confectionary

Of vegetarians, 18.1% had confectionary more than once a week, compared to 31.2% of non-vegetarians. Of vegetarians, 54.5% had confectionary 3 times a month or less compared to 41.9% of non-vegetarians (Table 5.3).

5.7.3 Sweet and savoury snacks

The frequency of intake of snacks among vegetarians and non-vegetarians did not appear to be appreciably different. Most vegetarians and non-vegetarians included sweet foods (i.e. biscuits, cakes, slices, muffins, pastries, or muesli bars) once a week or more at 69.7% and 70.6% respectively. Highest relative intakes for sweet snacks in both diet groups were in the 2-6 times a week category.

Similarly, 69.7% of vegetarians included savoury snacks (i.e. chips and crackers) once a week or more, in comparison to 73.9% of non-vegetarians. Highest relative intakes for savoury snacks in both diet groups were again in the 2-6 times a week category (Table 5.3). It is of note that for both sweet and savoury snacks, more vegetarians than non-vegetarians did exclude or rarely consume.

5.7.4 Takeaways and fast food

The relative majority of intake of takeaways (i.e. McDonalds, KFC) was 1-3 times a month for both vegetarians (44.5%) and non-vegetarians (46.0%). Most vegetarians (77.8%) and non-vegetarians (70.6%) had takeaways 3 times a month or less. The relative majority of other ready to eat fast foods (i.e. pies), was highest for both vegetarian and non-vegetarians
in the exclude or rarely have category at 60.6% and 47.9% respectively (Table 5.3). More vegetarians than non-vegetarians excluded or rarely had takeaways and fast food.
Table 5.3: Comparison between frequency of intake of discretionary foods in vegetarians\textsuperscript{1,2} and non-vegetarians\textsuperscript{1,2}

<table>
<thead>
<tr>
<th>Questions</th>
<th>Exclude or rarely have</th>
<th>1-3 times a month</th>
<th>Weekly</th>
<th>2-6 times a week</th>
<th>Once or more a day</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often do you drink fizzy drinks? Exclude diet varieties.</td>
<td></td>
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</tr>
<tr>
<td>Vegetarian</td>
<td>75.8 (60.3-91.2)</td>
<td>15.1 (2.2-28.1)</td>
<td>9.1 (0-19.4)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Non-vegetarian</td>
<td>49.8 (43.0-56.5)</td>
<td>29.8 (23.6-35.9)</td>
<td>10.2 (6.1-14.3)</td>
<td>8.8 (5.0-12.7)</td>
<td>1.4 (0-3.0)</td>
</tr>
<tr>
<td>How often do you eat lollies, sweets, chocolate or confectionary?</td>
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<td></td>
</tr>
<tr>
<td>Vegetarian</td>
<td>21.2 (6.5-35.9)</td>
<td>33.3 (16.4-50.3)</td>
<td>27.3 (11.2-43.3)</td>
<td>15.1 (2.2-28.1)</td>
<td>3.0 (0-9.2)</td>
</tr>
<tr>
<td>Non-vegetarian</td>
<td>12.6 (8.1-17.0)</td>
<td>29.3 (23.2-35.4)</td>
<td>27.0 (21.0-33.0)</td>
<td>29.3 (23.2-35.4)</td>
<td>1.9 (0-3.7)</td>
</tr>
<tr>
<td>How often do you eat biscuits, cakes, slices, muffins, sweet pastries or muesli bars? Include nut and other snack bars.</td>
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</tr>
<tr>
<td>Vegetarian</td>
<td>12.1 (0.4-23.9)</td>
<td>18.2 (4.3-32.1)</td>
<td>21.2 (6.5-35.9)</td>
<td>39.4 (21.8-57.0)</td>
<td>9.1 (0-19.4)</td>
</tr>
<tr>
<td>Non-vegetarian</td>
<td>9.9 (5.8-13.8)</td>
<td>19.5 (14.2-24.9)</td>
<td>17.2 (12.1-22.3)</td>
<td>38.1 (31.6-44.7)</td>
<td>15.3 (10.5-20.2)</td>
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</tbody>
</table>

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How often do you eat savoury snacks such as chips (crisps not hot chips) and crackers?

<table>
<thead>
<tr>
<th></th>
<th>Vegetarian</th>
<th>Non-vegetarian</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>3.0 (0-9.2)</td>
<td>7.9 (4.3-11.5)</td>
</tr>
<tr>
<td></td>
<td>27.3 (11.2-43.3)</td>
<td>18.2 (12.9-23.3)</td>
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<tr>
<td></td>
<td>33.3 (16.4-50.3)</td>
<td>16.3 (11.3-21.3)</td>
</tr>
<tr>
<td></td>
<td>36.4 (19.0-53.7)</td>
<td>50.2 (43.5-57.0)</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>7.4 (3.9-11.0)</td>
</tr>
</tbody>
</table>

How often do you eat fast food or takeaways from places like McDonalds, KFC, Burger King, Pizza shops or fish and chip shops?

<table>
<thead>
<tr>
<th></th>
<th>Vegetarian</th>
<th>Non-vegetarian</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>33.3 (16.4-50.3)</td>
<td>24.6 (18.8-30.5)</td>
</tr>
<tr>
<td></td>
<td>44.5 (27.5-63.4)</td>
<td>46.0 (39.3-52.8)</td>
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<td></td>
<td>15.2 (2.2-28.1)</td>
<td>23.7 (18.0-29.5)</td>
</tr>
<tr>
<td></td>
<td>6.1 (0-14.7)</td>
<td>5.6 (2.5-8.7)</td>
</tr>
<tr>
<td></td>
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<td>0</td>
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</tbody>
</table>

How often do you eat pies and other hot food that you buy ready-to-eat?

<table>
<thead>
<tr>
<th></th>
<th>Vegetarian</th>
<th>Non-vegetarian</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>60.6 (43.0-78.2)</td>
<td>47.9 (41.2-54.6)</td>
</tr>
<tr>
<td></td>
<td>30.4 (13.8-46.9)</td>
<td>32.6 (26.2-38.9)</td>
</tr>
<tr>
<td></td>
<td>9.1 (0-19.4)</td>
<td>13.5 (8.9-18.1)</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>6.0 (2.8-9.3)</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

\(^1\) All data is prevalence (95% Confidence Interval)

\(^2\) Vegetarian n=33, Non-vegetarian n=215
5.8 Fruit and vegetables

Of vegetarians, 72.8% had 2 or more serves of fruit a day and therefore meet or exceeded national recommendations (Figure 5.7a), in comparison to 56.3% of non-vegetarians (Figure 5.7b). The plurality of vegetarians had 2 servings a day or 3 or more servings a day equally at 36.4%. The plurality of non-vegetarians had 2 serves of fruit a day at 30.2% (Table 5.4).

Most vegetarians (63.6%, 95% CI: 46.3-81.0) met national recommendations for vegetable intake at 3 or more serves a day (Figure 5.8a), and this was significantly different to non-vegetarians at 31.2% (95% CI: 24.9-37.4) (Figure 5.8b). The plurality of both vegetarians and non-vegetarians have 3 or more servings of vegetables a day at 63.6% and 31.2% respectively (Table 5.4).
Table 5.4. Comparison between fruit and vegetable intake in vegetarians\(^1,2\) and non-vegetarians\(^1,2\)

<table>
<thead>
<tr>
<th>Questions</th>
<th>Less than 1 serving a week</th>
<th>1-4 servings a week</th>
<th>5 servings a week-daily</th>
<th>2 servings a day</th>
<th>3 or more servings a day</th>
</tr>
</thead>
<tbody>
<tr>
<td>On average how many servings of fruit do you eat per day or per week?(^3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetarian</td>
<td>6.0 (0-14.7)</td>
<td>9.1 (0-19.4)</td>
<td>12.1 (0.3-23.9)</td>
<td>36.4 (19.0-53.9)</td>
<td>36.4 (19.0-53.9)</td>
</tr>
<tr>
<td>Non-vegetarian</td>
<td>6.5 (3.2-9.8)</td>
<td>18.1 (12.9-23.3)</td>
<td>19.1 (13.8-24.4)</td>
<td>30.2 (24.0-36.4)</td>
<td>26.1 (20.1-32.0)</td>
</tr>
<tr>
<td>On average how many servings of vegetables do you eat per day or per week?(^4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetarian</td>
<td>0</td>
<td>0</td>
<td>9.1 (0-19.4)</td>
<td>27.3 (11.2-43.3)</td>
<td>63.6 (46.3-81.0)</td>
</tr>
<tr>
<td>Non-vegetarian</td>
<td>1.4 (0-3.0)</td>
<td>12.6 (8.1-17.0)</td>
<td>26.0 (20.1-32.0)</td>
<td>28.8 (22.7-35.0)</td>
<td>31.2 (24.9-37.4)</td>
</tr>
</tbody>
</table>

\(^1\) All data is prevalence (95% Confidence Interval)
\(^2\) Vegetarian n=33, Non-vegetarian n=215
\(^3\) Fruit includes fresh, frozen, canned or stewed. Excludes fruit juice or dried fruit
\(^4\) Vegetables includes fresh, frozen, or canned. Excludes vegetable juice
Figure 5.7a: Prevalence of vegetarians meeting and exceeding national recommendations for fruit intake

<table>
<thead>
<tr>
<th>Vegetarian</th>
<th>Non-Vegetarian</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meeting</td>
<td>73%</td>
</tr>
<tr>
<td>Not</td>
<td>27%</td>
</tr>
</tbody>
</table>

n=33

Figure 5.7b: Prevalence of non-vegetarians meeting and exceeding national recommendations for fruit intake

<table>
<thead>
<tr>
<th>Non-Vegetarian</th>
<th>Vegetarian</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meeting</td>
<td>50%</td>
</tr>
<tr>
<td>Not meeting</td>
<td>44%</td>
</tr>
</tbody>
</table>

n=215
Figure 5.8a: Prevalence of vegetarians meeting national recommendations for vegetable intake\textsuperscript{1,2}

Figure 5.8b: Prevalence of non-vegetarians meeting national recommendations for vegetable intake\textsuperscript{1,2}

\textsuperscript{1} vegetarian n=33

\textsuperscript{2} non-vegetarian n=215
6. Discussion

This thesis assessed dietary habits of vegetarian and non-vegetarian adolescent females in New Zealand. Animal proteins such as dairy and eggs were consumed less frequently by vegetarians than non-vegetarians. Although vegetarians consumed vegetarian protein alternative foods more frequently than non-vegetarians, intakes were unlikely to meet national recommendations. National recommendations around milk and milk product food groups were also unlikely to be met by both vegetarians and non-vegetarians. Fruit and vegetables were consumed more frequently and discretionary foods less frequently in vegetarians than non-vegetarians. These markers of food behaviours may indicate that vegetarians overall may have more healthful dietary habits than non-vegetarians (79).

6.1 Flesh based protein foods, vegetarian protein foods, and eggs

It is difficult to compare our findings to previous literature which present intakes of foods as mean g/d, g per % of standardised energy per day, % of energy intake per day, or serves per day (10, 11, 16-18), as opposed to the categories of frequency of consumption used in our study. However, general trends of food intakes between vegetarians and non-vegetarians in the current study are consistent with previous research. For example, vegetarians had significantly lower intakes of red and processed meat, poultry, and fish than non-vegetarians, with higher intakes of legumes and vegetarian protein alternatives such as vegetarian patties, legumes, and soy protein products (10, 11). The findings of Segovia-Siapco et al in adolescent vegetarians in the United States agree with this finding.
Vegetarians in our study consumed some flesh foods, in descending order: fish, seafood, poultry, red and processed meats, and pork, which is also consistent with other studies that defined vegetarianism by self-report (45).

Although intakes of vegetarian alternatives were higher in vegetarians than non-vegetarians, these foods were still low in the vegetarian diet. The present study found that vegetarian protein alternatives were most commonly consumed 3 times a month or less in vegetarians, with the exception of legumes, of which the majority included 2-6 times week. This may indicate that vegetarians are not substituting excluded flesh-based protein sources with vegetarian alternatives in sufficient amounts.

Papier et al (10) concluded overall protein intakes were low in vegetarians, because they increase their consumption of a large variety of plant-based foods such as wholegrains, as opposed to consuming high-protein plant- based and animal foods. Bread intakes were found to be the highest contributor to protein intakes in New Zealand adolescent females in the ANS (at 10.8%, poultry comparably contributes 9.8%) (19). In the present study non-vegetarians consumed bread more frequently than vegetarians. Examining these foods collectively suggests that protein food intakes among vegetarians are lower compared to non-vegetarians, a finding not unique to our study. However, it is not possible to make conclusions on the adequacy of protein intakes from this food group data.

The relative majority of vegetarians in the present study excluded eggs. This finding has been reported previously (10, 18). Comparatively, non-vegetarians were most likely to
include eggs 2-6 times a week. This in contrast to a study by Alles et al (16), which concluded egg intakes were higher in vegetarians. However, when comparing gram amounts of egg consumed by vegetarians in the study by Alles et al, with gram amounts in studies that found egg intakes to be lower in vegetarians, there was minimal difference (10, 11). The differential finding by Alles et al is likely related to low egg intakes in non-vegetarians (13g/day in non-vegetarians vs 17g/day in vegetarians) as the comparison group, as opposed to high intakes in vegetarians. Overall, the research agrees that the majority of vegetarians exclude eggs in addition to flesh based foods.

National recommendations for meat alternatives in adolescent vegetarians are three serves of legumes, tofu, eggs, nuts, or seeds a day (38). This guideline is unlikely to be achieved by the study population, given that vegetarian protein alternatives were most commonly consumed 3 times a month or less in vegetarians. Collectively, these protein-rich foods are needed in a vegetarian diet to reduce risk of nutritional inadequacy, and individually, they are rich in different nutrients conducive to health. Vegetarian alternatives contain protein, iron, zinc, and calcium. Eggs are a complete protein, and provide vitamin B12, vitamin D, and zinc. The most common and bioavailable vegetarian food source of vitamin B12 is in eggs and dairy. If low, vitamin B12 can cause anaemia, and is known to be low even in omnivorous females. Further research is needed in this population to definitively determine intakes of meat alternative foods and associated nutrients for this reason.
6.2 Milk and dairy

The majority of vegetarians excluded cows milk and dairy. Previous studies have found that cows milk intakes are about 50 g/d lower in vegetarians than non-vegetarians (10, 11). Only 6% of vegetarians, in comparison to 34.5% of non-vegetarians, included cows milk once or more a day. Interestingly, overall milk intake in the present study was not substantially different between vegetarians and non-vegetarians. This suggests that vegetarians are substituting cows milk for plant-based milks, which is plausible given that 63.8% of vegetarians reported consuming plant-based milk. This is similar to previous findings with Papier et al (10) and Bradbury et al (11) concluding that cows milk is lower and plant-based milk higher, in vegetarians than non-vegetarians.

When assessing overall dairy intake, the literature (10, 11, 16, 20) is supportive of our findings of lower intakes among vegetarians than non-vegetarians. In the present study only 12.1% of vegetarians included other dairy once or more a day, in comparison to 31.6% of non-vegetarians. When assessing dairy foods separately as yoghurt and cheese, there are more inconsistencies. Cheese consumption was lower in vegetarians in the study by Segovia-Siapco et al (18), but higher in studies by Papier et al and Bradbury et al. Yoghurt consumption was higher in vegetarians in the study by Bradbury et al, however this was negligible at approximately 10g/day. Interpretation of these results are limited as Bradbury et al and Papier et al did not specify whether ‘dairy’ products were plant-based or cow-based, whereas Segovia-Siapco et al specifically examined cow-based dairy, which was lower among vegetarians.
Vegetarians are unlikely to meet national adolescent guidelines of milk, milk products, and alternatives of 3 serves a day (38). It is of note that dairy intakes were also low in non-vegetarians and unlikely to meet national recommendations. Dairy products provide protein, vitamin B12, zinc, and calcium (15). Adequate intakes of calcium are important, especially in adolescence, to assist in achieving peak bone mass (67). Low intakes are associated with increased risk of osteoporosis later in life (67). Further research is needed in this population to definitively determine intakes of milk, milk products and alternatives, and associated nutrients for this reason.

### 6.3 Discretionary foods

In comparison to non-vegetarians, vegetarians more frequently excluded or rarely consumed discretionary foods such as fizzy drinks, confectionary, sweet and savoury treats, takeaways, and ready to eat fast foods. This difference was pronounced for fizzy drinks. These findings are consistent with other investigators who also concluded that vegetarians consume less SSBs (18), cake, ice-cream, biscuits, and crisps than non-vegetarians (10, 11, 17). Interestingly, a systematic review on adolescent females found substantially higher intakes of takeaways and fast foods, sweet and salty snacks, and SSBs than both diet groups in the present study (13). This review was conducted in low- and middle-income countries, which may explain this result, however comparisons to the ANS also showed lower intakes of fast food, takeaways and SSBs in the present study (19). This may indicate that our population was more healthful than the standard adolescent female population. Interestingly, the trend of vegetarians having lower intakes of discretionary foods than non-vegetarians remains.
Discretionary foods can be markers of unhealthful behaviours. Dietary patterns that are high in these foods also tend to low in fruits and vegetables (32), and high in energy, saturated fat, added sugars, and sodium (80). Although nutrients were not assessed in this thesis, fruit and vegetable intakes were higher in vegetarians than non-vegetarians. This appears to demonstrate that vegetarians in this study are consciously make healthful dietary choices, despite their low intakes of high-protein foods.

### 6.4 Fruit and vegetables

Vegetarians were more likely than non-vegetarians to meet national guidelines in New Zealand of at least 2 serves of fruit and 3 serves of vegetables a day, than non-vegetarians. Of vegetarians, 72.8% have 2 or more serves of fruit a day, in comparison to 56.3% of non-vegetarians. This is in comparison to females aged 15-18 years in the ANS, of which 65% had 2 or more servings of fruit a day (19). Similarly, approximately twice as many vegetarians than non-vegetarians (63.6% vs 31.2%) met national vegetable intake recommendations. This can be compared to the ANS at 61.5% (19). The majority of literature confirms that vegetarians have appreciably higher intakes of fruit and vegetables than non-vegetarians. This remains true in adolescent vegetarians with Segovia-Siapco et al (18) reporting vegetarians consumed approximately ½ a serve more of fruit and 1 serve more of vegetables a day than non-vegetarians.

Compared to non-vegetarians, vegetarians consumed less discretionary foods and more fruit and vegetables. This is indicative of a diet that is more consistent with overall dietary
guidelines (38). This is not a unique finding, with Clarys et al concluding that despite low protein intakes, vegetarians still had higher diet quality scores than omnivores (79).

6.5 Limitations and strengths

Several limitations should be considered when interpreting our findings. The percent of vegetarians in our study was 13.3% (n=33). Our results must be interpreted with caution due to small sample size. However, this percentage is similar to the prevalence of vegetarianism estimated among 14-24 year olds in New Zealand (12). The use of a DHQ presents limitations such as recall bias, and was not validated in the population of use (40). As serving sizes were not directly measured, it was not possible to compare intakes to national recommendations. Protein sources in the vegetarian diet were not exhaustively examined (i.e. nut intake) which also made definitive conclusions around adequacy of the diet impossible. However, all major protein-rich foods were included and analysed. The use of an updated questionnaire made comparisons to the ANS difficult. However, the updated food list was more likely to capture dietary intakes in the current adolescent population. Lastly, nine frequency of intake options were combined to form five categories for analysis. Whilst this increased simplicity, it reduced specificity.

The strengths of this study include a low respondent burden with the use of a food frequency questionnaire. Defining vegetarians by participant self-report as opposed to exclusion of animal foods in their diet may contribute to a more realistic picture of how modern-day dietary habits of vegetarians are practiced. Furthermore, while we did not analyse the subcategories of vegetarians, overall differences between vegetarians and non-
vegetarians remained appreciable. Data was collected from several cities, school locations, and NZDep indexes to be as representative as possible of the New Zealand population.

### 6.6 Conclusion

In summary, this study suggests the dietary habits of vegetarian and non-vegetarian adolescents differ, and this goes beyond the exclusion of flesh-based foods. In agreement with other studies, vegetarians consumed less flesh and animal-based protein-rich foods and discretionary foods, and more vegetarian protein alternatives and fruit and vegetables than non-vegetarians (10, 11, 16, 18). Despite this, vegetarians appeared unlikely to meet national adolescent guidelines for meat alternatives and milk and milk products (38). In non-vegetarians, intakes of milk products also appeared insufficient to meet recommendations. This may have implications for nutrient intakes (1, 9). However, the present study does not allow us to draw definitive conclusions on adequacy of the diet. It does appear from our study that vegetarians overall more frequently practice healthful dietary habits. Despite this, vegetarian diets need to be well-planned so food group recommendations are being met, and intakes of protein-containing foods and associated nutrients are not compromised. Further research into intakes of milk and milk products and vegetarian protein alternatives for comparison to national guidelines is needed to confirm potential low intakes of these protein-rich foods and associated nutrients in this population.
7. Application of Research to Dietetic Practice

Part A: Applicability and relevance of the research to Dietetic practice

In adolescent female vegetarians, the present study has highlighted the importance of determining intakes of not only high protein vegetarian alternative foods, but also intakes of animal products such as egg and dairy, and a wide range of plant-based foods. Intakes of milk and milk products, and meat alternatives are likely to be low in this population. It is important to compare intakes of these foods to nutritional guidelines, as they may have nutritional implications. In particular, low intakes of vitamin B12 and iron containing foods are of concern, given that Vitamin B12 is only found in animal foods and female adolescents are at risk of low iron. It is important to note that among vegetarians, assessing intakes of common markers of protein intake, such as high protein foods, may not be adequate to definitively conclude intakes of protein. It may be important to assess a wide range of plant foods that may be low in protein but consumed in high quantities in the diet. As a Dietitian, encouraging adolescent vegetarians to increase their consumption of not only high protein plant foods, but a wide range of plant-based foods, and milk and milk alternatives in sufficient quantities specified in national guidelines, is important to ensure nutritional adequacy. This research, although similar to what is currently known around vegetarians, confirms global findings specifically in the New Zealand female population. It also updates current knowledge around dietary habits of the general adolescent female population, of which it was noted also appear to have low intakes of milk and milk products and meat and alternatives.
**Part B: Reflective practice: What this research experience has meant to be**

An aspect of my research journey that stands out as being particularly important for my growth as a Dietitian is my new-found confidence in my time management skills and goal setting practices. Managing my time on thesis was my biggest challenge and biggest area of growth. Coming from 4 years of university where lecture times were set and due dates for assignments were imminent, the idea of writing for 6 months with no externally imposed deadlines aside was daunting. I learnt to hold myself accountable to working hours each day, set overall weekly goals, and set daily goals at the start of each week. I learnt that when I am working entirely to my own schedule, this is necessary for me to remain focused and achieve what I need to. This thesis taught me organizational skills and self-discipline above and beyond what I have learnt so far at university. I have confidence in my ability to manage myself after writing this thesis that I did not have at the beginning of this journey. This is something I will take with me long after hand in. I believe these skills will have a lifelong positive impact on my future career as a Dietitian, particularly as I hope to one day be self-employed in this field.
8. References

23. Philipsen SC. Validation of a newly developed eating habits questionnaire for New Zealand women [Masters Thesis]: Massey University, New Zealand; 2015.
43. Houstan ZL. Development and validation of a semi-quantitative food frequency questionnaire to assess dietary intake of adult women living in New Zealand [Masters Thesis]: Massey University, New Zealand; 2014.
9. Appendices

Appendix A: Ethics proposal and Approval letter

Appendix B: Ngāi Tahu Research Consultation Committee research proposal and approval letter

Appendix C: Consent form (from enrolment questionnaire)

Appendix D: Participant information sheet

Appendix E: Vegetarian status questions (from enrolment questionnaire)

Appendix F: Demographic questions (from enrolment questionnaire)

Appendix G: Anthropometrics protocol

Appendix H: Dietary habits questionnaire
Appendix A: Ethics proposal and Approval letter

Dr J Haszard  
Department of Human Nutrition  
Division of Sciences

4 February 2019

Dear Dr Haszard,

I am writing to let you know that, at its recent meeting, the Ethics Committee considered your proposal entitled “SuNDiAL Project 2019: Survey of Nutrition Dietary Assessment and Lifestyle Phase 1: Adolescent Females”.

As a result of that consideration, the current status of your proposal is:- **Approved**

For your future reference, the Ethics Committee’s reference code for this project is:- **H19/004**.

The comments and views expressed by the Ethics Committee concerning your proposal are as follows:-

While approving the application, the Committee would be grateful if you would respond to the following:

**Information Sheet**

A typing error was noted on the Information Sheet, under the heading “Is there any risk of discomfort or harm from participation?”, line 3, “some” should read “someone”.

**Consent Form**

Please amend the Consent Form to include an option for participants to indicate whether they would prefer for their blood samples to be disposed of using standard methods or with a Karakia.

Please provide the Committee with copies of the updated documents, if changes have been necessary.

The standard conditions of approval for all human research projects reviewed and approved by the Committee are the following:

Conduct the research project strictly in accordance with the research proposal submitted and granted ethics approval, including any amendments required to be made to the proposal by the Human Research Ethics Committee.
Inform the Human Research Ethics Committee immediately of anything which may warrant review of ethics approval of the research project, including: serious or unexpected adverse effects on participants; unforeseen events that might affect continued ethical acceptability of the project; and a written report about these matters must be submitted to the Academic Committees Office by no later than the next working day after recognition of an adverse occurrence/event. Please note that in cases of adverse events an incident report should also be made to the Health and Safety Office:

http://www.otago.ac.nz/healthandsafety/index.html

Advise the Committee in writing as soon as practicable if the research project is discontinued.

Make no change to the project as approved in its entirety by the Committee, including any wording in any document approved as part of the project, without prior written approval of the Committee for any change. If you are applying for an amendment to your approved research, please email your request to the Academic Committees Office:

gary.witte@otago.ac.nz

jo.farrondediay@otago.ac.nz

Approval is for up to three years from the date of this letter. If this project has not been completed within three years from the date of this letter, re-approval or an extension of approval must be requested. If the nature, consent, location, procedures or personnel of your approved application change, please advise me in writing.

The Human Ethics Committee (Health) asks for a Final Report to be provided upon completion of the study. The Final Report template can be found on the Human Ethics Web Page http://www.otago.ac.nz/council/committees/committees/HumanEthicsCommittees.html

Yours sincerely,

[Signature]

Mr Gary Witte
Manager, Academic Committees
Tel: 479 8256
Email: gary.witte@otago.ac.nz

c.c. Assoc. Prof. L Houghton  Department of Human Nutrition
Appendix B: Ngāi Tahu Research Consultation Committee research proposal and approval letter

Mon, 17 December 2018

Dr Meredith Peddie
Department of Human Nutrition

Tēnā Koe Dr Meredith Peddie


The Ngāi Tahu Research Consultation Committee (the Committee) met on Tuesday, 11 December 2018 to discuss your research proposition.

By way of introduction, this response from The Committee is provided as part of the Memorandum of Understanding between Te Rūnanga o Ngāi Tahu and the University. In the statement of principles of the memorandum it states "Ngāi Tahu acknowledges that the consultation process outlined in this policy provides no power of veto by Ngāi Tahu to research undertaken at the University of Otago". As such, this response is not "approval" or "mandate" for the research, rather it is a mandated response from a Ngāi Tahu appointed Committee. This process is part of a number of requirements for researchers to undertake and does not cover other issues relating to ethics, including methodology they are separate requirements with other Committees, for example the Human Ethics Committee, etc.

Within the context of the Policy for Research Consultation with Māori, the Committee base consultation on that defined by Justice McGechan:

"Consultation does not mean negotiation or agreement. It means: setting out a proposal not fully decided upon; adequately informing a party about relevant information upon which the proposal is based; listening to what the others have to say with an open mind (in that there is room to be persuaded against the proposal); undertaking that task in a genuine and not cosmetic manner. Reaching a decision that may or may not alter the original proposal."

The Committee considers the research to be of importance to Māori health.

As this study involves human participants, the Committee strongly encourages that ethnicity data be collected as part of the research project as a right to express their self-identity.

The Committee suggests researchers consider the Southern District Health Board's Tikaka Best Practice document, in particular patient engagement. The document also covers the collection, storage and disposal of blood and tissue samples. This document is available on the Southern District Health Board website. The Committee also refers researchers to Te Mana Raranga Māori Data Audit Tool, which gives an overview of key Māori Data Sovereignty terms and principles.
We wish you every success in your research and the Committee also requests a copy of the research findings.

This letter of suggestion, recommendation and advice is current for an 18-month period from Tuesday, 11 December 2018 to 3 June 2020.

The recommendations and suggestions above are provided on your proposal submitted through the consultation website process. These recommendations and suggestions do not necessarily relate to ethical issues with the research, including methodology. Other Committees may also provide feedback in these areas.

Nāhaku noa, nā

Claire Porima  
Kaiwhakahaere Pūtere  
Senior Project Manager  
Office of Māori Development  
Te Whare Wānanga o Otago  
Ph: +64 3 479 7461  
Email: claire.porima@otago.ac.nz  
Web: www.otago.ac.nz
Appendix C: Online Consent (from enrolment questionnaire)
You have had all your questions answered about the study and understand that you can ask for more information at any stage.

You know that when the project is completed all personal information that could be linked to you will be removed from the paper records and electronic files for the project, and that these will be placed in secure storage and kept for at least ten years.

You are a young woman who is 15 to 18 years old and isn't pregnant

You know you can pull out of the study anytime before it finishes in October 2019.

If you don't want to take part in the SuNDiAL project, please click on the “disagree” button.

AGREE
DISAGREE
Thank you! You are eligible to take part in the SuNDiAL project!

There are three other parts to the SuNDiAL project that are optional. Please read the following information carefully before you decide whether to take part in these optional bits of the study. For each one of these that you do, you will receive a $5 gift voucher from New World or PaknSave.

If you agree to do these, but change your mind later, that’s OK - there is no disadvantage to not you if you decide not to do these.

Once all of the analysis has been completed the samples will be disposed of using standard biohazard protocols. On the consent form (below) you can tell us if you would like your blood sample disposed of with a Karakia (Māori Prayer).

Electronic consent
Click on the "AGREE" button below if:
- You have read the information on the website
- You want to take part in these parts of the study

If you don’t want to take part in these parts of the study, please click on the "DISAGREE" button.

BLOOD SAMPLE:
We would like you to provide a blood sample (which would be collected by someone with extensive training in how to collect blood), but we understand that not everyone feels comfortable about this so it is entirely up to you if you do this. If you do provide a blood sample, we can tell you whether you’re iron deficient or not. You can still take part in the rest of the study even if you don’t do this bit.

Click on the agree button below if:
You understand the risks of discomfort involved in providing a blood sample

☐ AGREE
☐ DISAGREE

Please click here if you want your samples disposed of with a Karakia (Māori Prayer)

☐ Yes
☐ No

URINE SAMPLE:
We would also like you to give a urine sample ("pee or wee") - which is easy for you collect yourself with the equipment we give you. You can still take part in the rest of the study even if you don’t do this bit.

Click on the ‘AGREE’ button below if:

☐ AGREE
☐ DISAGREE

ACCELEROMETER:
We would also like you to wear a small red box called an accelerometer on an elastic belt 24 hours a day for seven days. This will tell us how much time you spend sitting down, moving around, and sleeping. If you choose to wear the accelerometer you will be asked to complete a little diary about the times you took the device off, and what time you went to bed each night on the days that you wear it.

One of our research team will return to your school the week after this visit to collect the accelerometer. You can still take part in the rest of the study even if you don’t do this bit.

☐ AGREE
☐ DISAGREE
Appendix D: Participant information sheet

Participant Information Sheet

| Study title: | The SuNDiAL Project 2019: A survey of nutrition, dietary assessment and lifestyle |
| Principal investigators: | Names Dr Jill Hazard & Dr Meredith Peddie  
Department: Human Nutrition  
Position: Research Fellows |
| Contact phone number: | 03 479 5683  
03 479 8157 |

Introduction

Thank you for showing an interest in this project. Please read this information sheet carefully. Take time to think about it and talk with family or friends before you decide whether to take part or not.

If you decide to take part we thank you. If you decide not to take part that won’t disadvantage you and we thank you for considering our request.

What is the aim of this research project?

We don’t know much about teenage women’s food intakes and lifestyles in New Zealand. We suspect that they don’t get enough of some nutrients like iron sometimes, and that this can make them feel tired and affect their health. Teenagers often make their own decisions about what foods to eat, but we don’t know very much about why they choose the foods they eat. Therefore in 2019 the SuNDiAL project is going to investigate food intakes, nutrition, health, and why female high school students (aged 15-18 years) choose to eat the way they do.

Who is funding this project?

This project is funded by the Department of Human Nutrition, University of Otago, and a Lottery Health Research Grant.
Who are we seeking to participate in the project?

We are looking for at least 300 female high school students who are between 15 and 18 years old. To be eligible to take part, your high school must have agreed to take part in the study, or you must live in Dunedin and be able to attend a clinic visit at the Department of Human Nutrition after school, you must speak and understand English, and be able to complete the questionnaires.

If you participate, what will you be asked to do?

If you agree to take part in this study you will be asked to do three things:

1) **Complete an online questionnaire**
   After you have completed the consent process you will be asked to complete a questionnaire that asks questions about your health and some general questions such as what ethnicity you identify with this questionnaire also asks you about your overall eating habits, and why you choose to eat the foods that you do. This questionnaire will take about 30 min to complete.

2) **Attend a session at your school, or at the Department of Human Nutrition with our research team**
   This visit will take about 60 minutes and you will be asked to:
   - Complete a face to face interview with one of our research team during which you will be asked to recall everything you ate and drank the day before.
   - At this session one of our research team will also measure your height, your weight, and the length of your lower arm – these measurements will be done twice to make sure they are as accurate as possible. This will be done in a private space and you won’t be told these measurements unless you ask for them.

3) **Complete a second interview about the food you have eaten on another day**
   Sometime in the 2 weeks after you have finished the session at school, or at the Department of Human Nutrition, you will be contacted by the research team and asked to complete a second interview in which you will be asked to recall everything you ate and drank on a different day of the week than the first interview. This is important because sometimes you can eat quite differently from one day to the next. **This interview will be performed over facetime or zoom, at a time that is convenient for you.**

There are three other parts to the SuNDiAL project that are entirely optional.
Please read the following information carefully before you decide whether to take part in these optional bits of the study. If you agree to do these, but change your mind later, that’s OK - there is no disadvantage to not you if you decide not to do these. You will be asked again on the day if you still want to do them.

1) **Provide a blood sample**
   We would like you to provide a blood sample (which would be collected by someone with extensive training in how to collect blood during the session at school, or at the Department of Human Nutrition), but we understand that not everyone feels comfortable about this so it is entirely up to you if you do this. However, if you do provide a blood sample, we can tell you whether you’re iron deficient or not. You can still take part in the rest of the study even if you don’t do this bit.
2) **Provide a urine sample**

We would also like you to give a urine (“pee”) sample (which is easy for you collect yourself in the bathroom with the equipment we give you, during the session at school, or at the Department of Human Nutrition). You can still take part in the rest of the study even if you don’t do this bit.

3) **Wear an accelerometer for a week**

We would also like you to wear a small red box called an accelerometer on an elastic belt 24 hours a day for the seven days following the session at your school. This will tell us how much time you spend sitting down, moving around, and sleeping. If you choose to wear the accelerometer you will be asked to complete a little diary about the times your took the device off, and what time you went to bed each night on the days that you wear it. One of our research team will return to your school the week after this visit to collect the accelerometer, or will arrange a time to collect it from you. You can still take part in the rest of the study even if you don’t do this bit.

After the completion of the study you will receive a $5 voucher for each component of the study that you complete. That is $5 for completing the online questionnaire, $5 for completing the face to face interview about what you ate in the last 24 hours, $5 for completing the second interview about what you ate; $5 for providing a blood sample; $5 for providing a urine sample or $5 for wearing the accelerometer for a week. Adding to a possible total of $30 in vouchers.

**Is there any risk of discomfort or harm from participation?**

If you choose to provide a blood sample, you should know that there is a risk of a little pain or discomfort, and possibly a small bruise from the blood test. Any bruising should only last a few days and an experienced nurse or phlebotomist (someone with training to take blood samples) will collect the blood to minimize any discomfort to you.

**What specimens, data or information will be collected, and how will they be used?**

The answers you provide to the questionnaires and the food questionnaire will be entered into a database with every other participants’ answers. All your answers will be kept confidential and stored using an id number, not your name. This information will provide valuable and unique information about the nutrition status of female high school students in New Zealand. Information about why people eat the way they do will also be very helpful if some eating patterns provide health benefits. Ultimately, the results of this study will support the development of up-to-date government and health agency guidelines for young women in New Zealand.

If you provide a blood sample it will be divided into 3 separate parts. One part will be taken to a local laboratory where it will be analysed for Vitamin B12 concentrations and a complete blood count. The other two parts of your blood sample will be transported to the Department of Human Nutrition at
the University of Otago where they will be stored in a freezer until we have finished collecting all the blood samples from around the country. When all the blood samples have been collected, one part of your blood sample will be sent to Germany where it will be analysed for ferritin, soluble transferrin receptor, retinol binding protein, C-reactive protein and alpha-glycoprotein. We are sending this sample to Germany because they have a special machine that can measure these things on a much smaller amount of blood, at a smaller cost, than we can do in New Zealand. The remaining part of your blood sample will remain at the Department of Human Nutrition, where it will be analysed for plasma selenium and plasma zinc, thiamin, plasma folate, Vitamin B6, Leptin, Interlukin-6 and blood lipids.

If you provide a urine sample it will also be transported to the Department of Human Nutrition at the University of Otago where it will be stored in a freezer until it is analysed for iodine concentrations.

Once all of the analysis on your blood and urine samples has been completed they will be disposed of using standard biohazard protocols. On the consent form you can indicate to us if you would like your samples disposed of with a Karakia (Māori Prayer). **We will only test your samples for the things listed here, and won’t test them for anything else.**

**What about anonymity and confidentiality?**

Your information will be identified with an ID number only in the database that contains the results of the study. This database will be stored on the researchers’ computers which are password protected. A backup copy may also be stored on the University’s shared server space, but only Jill Hassard and Meredith Peddie will have the password so no one else can access the information.

The information linking you to your ID number will be stored in a separate password protected file that only Jill Hassard and Meredith Peddie will have access to. The only reason they would access this information once you have completed the study would be if you requested your individual results. This file will be destroyed once all participants have been given the opportunity to request individual information. The de-identified information collected as part of this research will be kept in secure storage for at least 10 years.

**If you agree to participate, can you withdraw later?**

You may pull out of the project before the study has been completed (anticipated to be October 2019) without any disadvantage to yourself of any kind. Once data collection is completed and your information is integrated into the study it will no longer be possible to withdraw your information from the study.

**Any questions?**

If you have any questions now or in the future, please feel free to contact either:
<table>
<thead>
<tr>
<th>Name: Dr Jill Hazard</th>
<th>Contact phone number:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position: Senior Research Fellow</td>
<td>03 479 5683</td>
</tr>
<tr>
<td>Department of Human Nutrition</td>
<td></td>
</tr>
<tr>
<td>Name: Dr Meredith Peddie</td>
<td>Contact phone number:</td>
</tr>
<tr>
<td>Position: Research Fellow</td>
<td>03 479 8157</td>
</tr>
<tr>
<td>Department of Human Nutrition</td>
<td></td>
</tr>
</tbody>
</table>

This study has been approved by the University of Otago Human Ethics Committee (Health). If you have any concerns about the ethical conduct of the research you may contact the Committee through the Human Ethics Committee Administrator (phone +64 3 479 8256 or email gary.witte@otago.ac.nz). Any issues you raise will be treated in confidence and investigated and you will be informed of the outcome.
Appendix E: Vegetarian status questions (from enrolment questionnaire)

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are you vegetarian or vegan?</td>
<td>Yes, No</td>
</tr>
<tr>
<td>Which foods do you eat? (Select as many as apply)</td>
<td>Egg, Milk (not plant milk like soy milk), Fish or seafood, Chicken or poultry, Meat/red meat occasionally, None of the above</td>
</tr>
<tr>
<td>Are you vegan?</td>
<td>Yes, No</td>
</tr>
<tr>
<td>How long have you been following this way of eating?</td>
<td>Less than a month, Between 1 and 6 months, Between 6 months and 1 year, Between 1 and 2 years, More than 2 years, My whole life</td>
</tr>
</tbody>
</table>
Appendix F: Demographic questions (from enrolment questionnaire)

Thank you for agreeing to taking part in the SuNDiAL project! If you are female, aged 15-18 years of age and not pregnant, please answer the following two questions:

What age are you as of today?
- [ ] 15
- [ ] 16
- [ ] 17
- [ ] 18
- [ ] None of the above

What high school do you attend?
- [ ] Tauraroa Area School
- [ ] Mt Maunganui College
- [ ] Spotswood College
- [ ] Wellington Girls College
- [ ] Waimere College
- [ ] Hornby High School
- [ ] Columba College
- [ ] Kaikorai Valley College
- [ ] Queens High School
- [ ] Mt Aspiring College
- [ ] None of the above

Contact Information

What is your name? (Preferred first name, last name)

What is your date of birth? __________________________

Age __________________________

Phone number (mobile would be best - so we can text you reminders) __________________________

What is your home address? (This will be the address where we will send your voucher)
(number & street, suburb, city, postcode)

Do you live at this address during school term?  
- [ ] Yes
- [ ] No

Do you live in a boarding house during school term? (Don't include private boarding)  
- [ ] Yes
- [ ] No

Please put the name and/or address of the boarding house
(number & street, suburb, city, postcode)

What is the address that you live at during school term?  
(number & street, suburb, city, postcode)
<table>
<thead>
<tr>
<th>Other information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Which ethnic group do you belong to? (Mark those that apply)</strong></td>
</tr>
<tr>
<td>☐ New Zealand European</td>
</tr>
<tr>
<td>☐ Māori</td>
</tr>
<tr>
<td>☐ Samoan</td>
</tr>
<tr>
<td>☐ Cook Island Māori</td>
</tr>
<tr>
<td>☐ Tongan</td>
</tr>
<tr>
<td>☐ Niuean</td>
</tr>
<tr>
<td>☐ Chinese</td>
</tr>
<tr>
<td>☐ Indian</td>
</tr>
<tr>
<td>☐ Other such as Dutch, Japanese, Tokelauan, please state.</td>
</tr>
</tbody>
</table>

**Other: please state**

_____________________________
Appendix G: Protocol for anthropometry

ANTHROPOMETRIC MEASUREMENTS

Gain verbal consent from the participant for each measurement and explain fully what you will do to obtain them. Before beginning, gain consent from the participant to use non-permanent pen for marking anatomical land marks.

NB: anthropometry tapes have a blank lead before measurement markings start - consider this when reading a measurement.

HEIGHT
1. Ask the participant to remove their shoes, as well as any hair ornaments or buns/braids on the top of the head.

2. If the participant is taller than the investigator, use a step tool to take the measurements. Errors can be minimised by the investigator being parallel to the participant and the headpiece.

3. Tell the participant to stand with their heels together and toes apart pointing outward at approximately a 60-degree angle.

4. Make sure the back of the head, shoulder blades, buttocks, and heels of the participant are touching the backboard/stadiometer.

5. Make sure the participant’s head is aligned in the Frankfort horizontal plane, where a horizontal line connects from the ear canal to the lower border of the orbit of the eye.

6. Lower the headpiece to rest firmly on the top of the participant’s head and ask the participant to stand as tall as possible and take a deep breath.

7. Record the result to the nearest 0.1 cm in the HEIGHT 1 box on the recording sheet without informing the participants.
WEIGHT

1. Ask the participant to remove any heavy clothing (such as jackets, heavy tops, boots etc). As the participant would have just had their height measurement done, they should not be wearing shoes.

2. Turn on the scales, ensure they are switched on to metric (kg).

3. Ask the participant to step on to the scales so that they are facing away from the display (prevent seeing the weight) cautioning them that they need to step up onto the scales.

4. Wait for the scales to read or come to a stable number.

5. Record the participant’s weight to the nearest 0.1 kg in the WEIGHT 1 box on the recording sheet without informing the participant

ULNA LENGTH:

Ulna length is measured between the point of the elbow and the midpoint of the prominent bone of the wrist using an anthropometric tape. This value is then compared with a standardized height conversion chart. Participants should be dressed in light clothing with no wrist watch or other jewellery on the arm that is to be measured.

1. Measure between the point of the elbow and the midpoint of the prominent bone of the wrist (non-dominant side).

2. Read and accurately record the measurement to the nearest 0.1 cm in the UNLA LENGTH 1 box on the recording sheet without informing the participants

REPEAT ALL MEASUREMENTS

Repeat all three measurements again, in the same order, entering the measurements in the HEIGHT 2, WEIGHT 2 and ULNA LENGTH 2 box as appropriate (do no tell participant measurements).

CHECK: are any of the 1st and 2nd measurements are more than 0.5 units apart? If so take a third measurement where required.
Do the height, weight and ulna measurements fall within 0.5 of each other? (Subtract to find out e.g. HEIGHT 1 – HEIGHT 2)

YES (0.5 or lower): Don’t take a third measurement

NO (greater than 0.5): Take a third measurement
Appendix H: Dietary Habits Questionnaire

### Dietary Habits Questionnaire

**Fruit**

On average how many servings of fruit - fresh, frozen, canned or stewed - do you eat per day or per week? Do not include fruit juice or dried fruit.

A serving is the same as a medium piece of fruit like an apple or two small pieces of fruit like two apricots, or half a cup of stewed or canned fruit.

- Never I don't eat fruit
- Less than 1 serving a week
- 1 serving a week
- 2-4 servings a week
- 5-6 servings a week
- 1 serving a day
- 2 servings a day
- 3 servings a day
- More than 3 servings a day

---

**Vegetables**

On average how many servings of vegetables - fresh, frozen or canned - do you eat per day or per week? Do not include vegetable juices.

A serving is the same as one potato, half a cup of peas or a cup of salad.

- Never I don't eat vegetables
- Less than 1 serving a week
- 1 serving a week
- 2-4 servings a week
- 5-6 servings a week
- 1 serving a day
- 2 servings a day
- 3 servings a day
- More than 3 servings a day
Bread

On average how often do you eat bread?

Include slices of bread, rolls, bagels, wraps, and gluten-free bread.

- Never I don't eat bread
- Less than once a week
- Once a week
- 2-4 times a week
- 5-6 times a week
- Once a day
- Twice a day
- 3 times a day
- More than 3 times a day

What type of bread, rolls or toast do you eat most of the time?

- White
- Wholemeal (brown colour)
- Light grain - has some grains but soft to eat (eg honey grain)
- Heavy grain - has some grains and a bit chewier (eg Vogels)
- Other (please specify)

If Other, please specify:

______________________________________

Milk

How often do you have milk (cow's milk or plant milk)?

- I do not have any milk
- Rarely
- Monthly
- 2-3 times a month
- Once a week
- 2-4 times a week
- 5-6 times a week
- Once a day
- More than once a day

What type of milk do you use the most of?

- None
- Cow's milk
- Plant-based milk (eg soy, rice, almond, coconut)
- Other (such as goat or sheep milk)

What kind of milk do you usually have?

- Whole or standard milk (Dark blue or silver)
- Reduced fat (light blue)
- Skim or trim (green or yellow)
- Other (please specify)

If Other, please specify:

______________________________________

What kind of milk do you usually have?

- Regular
- Lite
- Sweetened or flavoured
Spreads and Oils

What type of spread do you use the most of?

- None
- Butter (including semi soft)
- Margarine (eg Canola, Sunflower, Olive oil based, or table spread)
- Other (eg avocado, cream cheese), please specify
- I don't know

If other, please specify:

What type of fat or oil is used most often in cooking in your household?

- None
- Butter
- Coconut oil
- Margarine
- Oil (eg Olive, Canola, or one in a bottle)
- Dripping or Lard
- I don't know

Nuts

How often do you eat the following types of nuts? (Include nuts in cooked foods, bars, cereals etc but don't include peanut butter or other nut butters)

<table>
<thead>
<tr>
<th></th>
<th>More than once a day</th>
<th>Once a day</th>
<th>5-6 times a week</th>
<th>2-4 times a week</th>
<th>Once a week</th>
<th>2-3 times a month</th>
<th>Monthly</th>
<th>Rarely</th>
<th>I do not eat these</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almonds</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Brazil</td>
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<td></td>
<td></td>
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<tr>
<td>Cashew</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hazelnut</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Macadamia</td>
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<td></td>
<td></td>
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<tr>
<td>Peanut</td>
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<tr>
<td>Pecan</td>
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<tr>
<td>Pine nut</td>
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<tr>
<td>Pistachio</td>
<td></td>
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<tr>
<td>Walnut</td>
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<tr>
<td>Other</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
### How often do you eat nut butters?

<table>
<thead>
<tr>
<th></th>
<th>More than once a day</th>
<th>Once a week</th>
<th>5-6 times a week</th>
<th>2-4 times a week</th>
<th>Once a month</th>
<th>2-3 times a month</th>
<th>Monthly</th>
<th>Rarely</th>
<th>I don't eat this type of nut butter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almond butter</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Cashew butter</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Hazelnut butter</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Peanut butter</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
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<tr>
<td>Walnut butter</td>
<td>○</td>
<td>○</td>
<td>○</td>
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<td>○</td>
<td>○</td>
<td>○</td>
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<td>○</td>
</tr>
<tr>
<td>Other</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

### Meat, Dairy and Eggs

#### How often do you eat each of the following foods:

<table>
<thead>
<tr>
<th></th>
<th>More than once a day</th>
<th>Once a week</th>
<th>5-6 times a week</th>
<th>2-4 times a week</th>
<th>Once a month</th>
<th>2-3 times a month</th>
<th>Monthly</th>
<th>Rarely</th>
<th>I do not eat this</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egg</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Cow's milk</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Dairy products excluding milk (eg cheese, yoghurt - don't include plant based)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Processed meat (eg ham, bacon, sausages, luncheon, canned corned beef, pastrami, salami)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
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<td>○</td>
</tr>
<tr>
<td>Other red meat (including beef, lamb, venison etc don't include processed meat)</td>
<td>○</td>
<td>○</td>
<td>○</td>
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<td>○</td>
<td>○</td>
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<td>○</td>
</tr>
<tr>
<td>Pork</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Poultry (including chicken, turkey etc)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
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</tr>
<tr>
<td>Fish</td>
<td>○</td>
<td>○</td>
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<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Other seafood/shellfish (eg prawns, squid, crab)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>
## Legumes

<table>
<thead>
<tr>
<th>How often do you eat lentils, chickpeas, kidney beans or baked beans? (Don't include peas or peanuts)</th>
</tr>
</thead>
</table>
| ○ I do not eat legumes  
| ○ Rarely  
| ○ Monthly  
| ○ 2-3 times a month  
| ○ Once a week  
| ○ 2-4 times a week  
| ○ 5-6 times a week  
| ○ Once a day  
| ○ More than once a day |

## Other Foods

<table>
<thead>
<tr>
<th>How often do you eat tofu, tempeh and tofu products?</th>
</tr>
</thead>
</table>
| ○ I do not eat these  
| ○ Rarely  
| ○ Monthly  
| ○ 2-3 times a month  
| ○ Once a week  
| ○ 2-4 times a week  
| ○ 5-6 times a week  
| ○ Once a day  
| ○ More than once a day |

<table>
<thead>
<tr>
<th>How often do you eat vegetarian ingredients (like quorn, nut meat, vegetarian mince) that are used in other dishes?</th>
</tr>
</thead>
</table>
| ○ I do not eat these  
| ○ Rarely  
| ○ Monthly  
| ○ 2-3 times a month  
| ○ Once a week  
| ○ 2-4 times a week  
| ○ 5-6 times a week  
| ○ Once a day  
| ○ More than once a day |

<table>
<thead>
<tr>
<th>How often do you eat vegetarian sausages, nuggets, patties etc?</th>
</tr>
</thead>
</table>
| ○ I do not eat vegetarian meat alternatives  
| ○ Rarely  
| ○ Monthly  
| ○ 2-3 times a month  
| ○ Once a week  
| ○ 2-4 times a week  
| ○ 5-6 times a week  
| ○ Once a day  
| ○ More than once a day |

<table>
<thead>
<tr>
<th>How often do you eat vegetarian “meat alternatives” (like chicken-free chicken, vegetarian chicken schnitzel, meat-free bacon rashers etc)?</th>
</tr>
</thead>
</table>
| ○ I do not eat these  
| ○ Rarely  
| ○ Monthly  
| ○ 2-3 times a month  
| ○ Once a week  
| ○ 2-4 times a week  
| ○ 5-6 times a week  
| ○ Once a day  
| ○ More than once a day |
### Sweet Drinks

**How often do you drink diet or drinks labelled “sugar-free”?**
- [ ] I do not drink diet or sugar-free drinks
- [ ] Rarely
- [ ] Monthly
- [ ] 2-3 times a month
- [ ] Once a week
- [ ] 2-4 times a week
- [ ] 5-6 times a week
- [ ] Once a day
- [ ] More than once a day

**How often do you drink fizzy drinks? Don't include diet varieties. (eg Coca-cola, Pepsi, lemonade)**
- [ ] I do not drink fizzy drinks
- [ ] Rarely
- [ ] Monthly
- [ ] 2-3 times a month
- [ ] Once a week
- [ ] 2-4 times a week
- [ ] 5-6 times a week
- [ ] Once a day
- [ ] More than once a day

**How often do you drink fruit juices, drinks or cordials? (eg Just Juice, Fresh-up, Keri, Golden Circle, Ribena, Charlie's, Raro).**
- [ ] I do not drink juice or cordial
- [ ] Rarely
- [ ] Monthly
- [ ] 2-3 times a month
- [ ] Once a week
- [ ] 2-4 times a week
- [ ] 5-6 times a week
- [ ] Once a day
- [ ] More than once a day

**Don't include diabetic, diet or sugar-free varieties.**

**How often do you drink energy drinks? (eg V, Lif plus, Red Bull, Powerade)**
- [ ] I do not drink energy drinks
- [ ] Rarely
- [ ] Monthly
- [ ] 2-3 times a month
- [ ] Once a week
- [ ] 2-4 times a week
- [ ] 5-6 times a week
- [ ] Once a day
- [ ] More than once a day
Snacks

How often do you eat lollies, sweets, chocolate or confectionary?

○ I do not eat these
○ Rarely
○ Monthly
○ 2-3 times a month
○ Once a week
○ 2-4 times a week
○ 5-6 times a week
○ Once a day
○ More than once a day

How often do you eat biscuits, cakes, slices, muffins, sweet pastries or muesli bars?

Include nut and other sweet snack bars.

○ I do not eat these
○ Rarely
○ Monthly
○ 2-3 times a month
○ Once a week
○ 2-4 times a week
○ 5-6 times a week
○ Once a day
○ More than once a day

How often do you eat savoury snacks such as chips (crisps not hot chips) and crackers?

○ I do not eat these
○ Rarely
○ Monthly
○ 2-3 times a month
○ Once a week
○ 2-4 times a week
○ 5-6 times a week
○ Once a day
○ More than once a day

Fast Food

How often do you eat fast food or takeaways from places like McDonalds, KFC, Burger King, Pizza shops or fish and chip shops?

○ I do not eat fast food
○ Rarely
○ Monthly
○ 2-3 times a month
○ Once a week
○ 2-4 times a week
○ 5-6 times a week
○ Once a day
○ More than once a day

How often do you eat pies and other hot food that you buy ready-to-eat?

○ I do not eat these
○ Rarely
○ Monthly
○ 2-3 times a month
○ Once a week
○ 2-4 times a week
○ 5-6 times a week
○ Once a day
○ More than once a day
## Breakfast Consumption

How many days in an average week do you have something to eat for breakfast?

- I don't usually have breakfast
- 1 day a week
- 2 days a week
- 3 days a week
- 4 days a week
- 5 days a week
- 6 days a week
- 7 days a week